News and Views

in the Biological Sciences

THE AIBS BULLETIN

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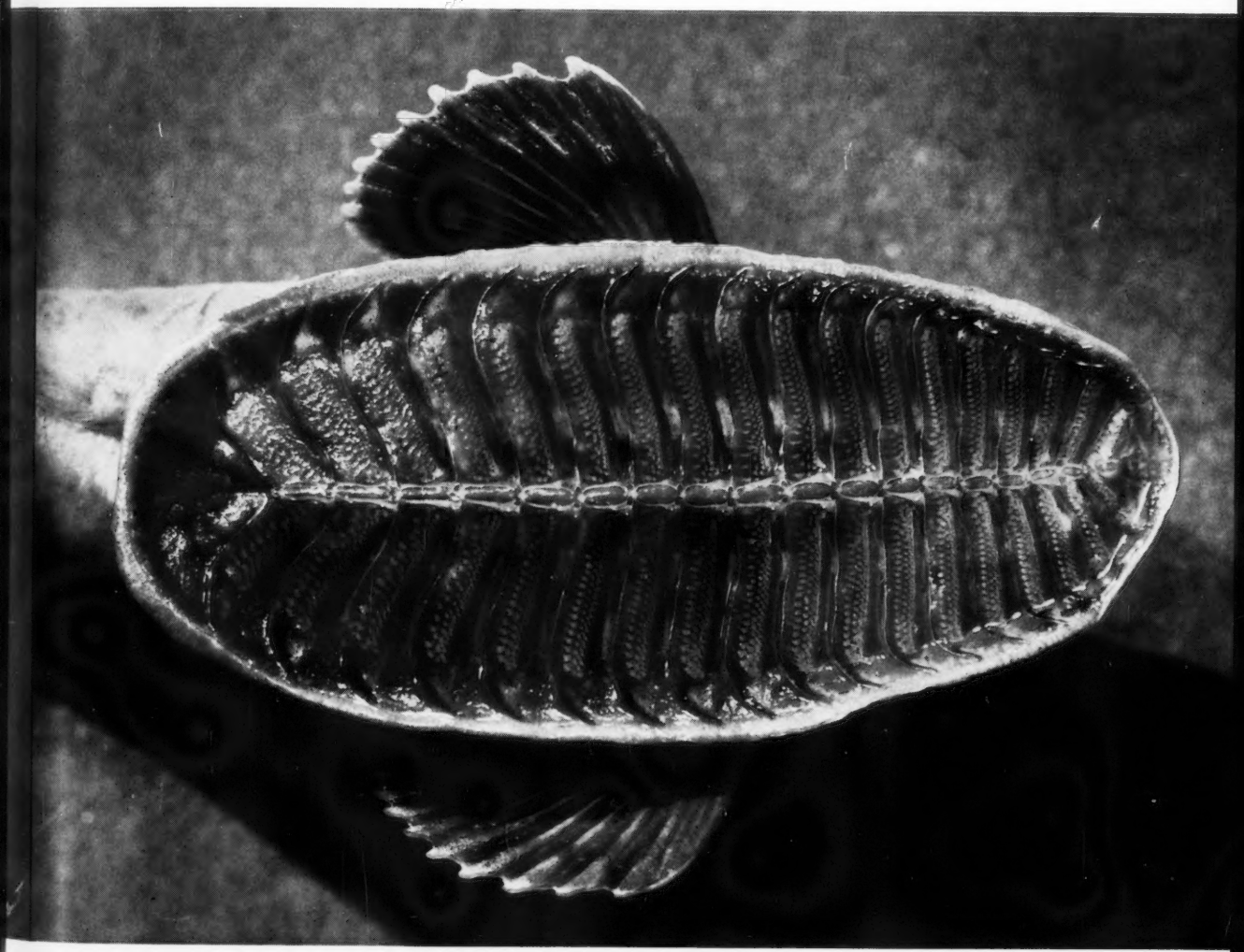

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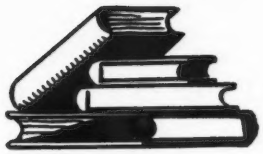
SAUNDERS  BOOKS

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By Bernard S. Strauss, Ph.D., Associate Professor of Zoology, Syracuse University. About 206 pages, with 22 illustrations.
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Edited by Theodore C. Ruch, Ph.D., Professor and Executive Officer, Department of Physiology and Biophysics, University of Washington School of Medicine; and John F. Fulton, M.D., Sterling Professor of the History of Medicine, Yale University School of Medicine. With 22 Contributors. About 1122 pages, with 616 illustrations.
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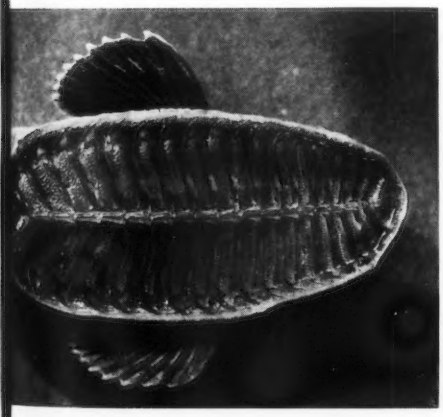

Cover Picture: SPEARFISH REMORA. *Rhombochirus osteochir.* First dorsal fin modified into sucking plate. Photo by: William H. Amos, Noxontown Road, Middletown, Delaware.

June 1960 · Volume X · Number 3

Editorial *14*

A Biologist's Reflections on History *15*
MAX HAMBURGH
Thoughts entertained on the 100th anniversary of the publication of Darwin's "Origin of Species by Natural Selection"

Creativity, Biology, and Education *21*
ROBERT W. MERRIAM
Making the most of individual ingenuity—a challenge that demands creativity in biological education

Science and Century 21 HAROLD F. OSBORNE *25*
A request for suggestions toward making the Century 21 Exposition more scientifically meaningful

Pre-Registration and Housing Form, Oklahoma Meetings *29*

Letters *5*

The Editor's Desk *31*

AIBS Reports *35*

Library *36*

Index to Advertisers *43*

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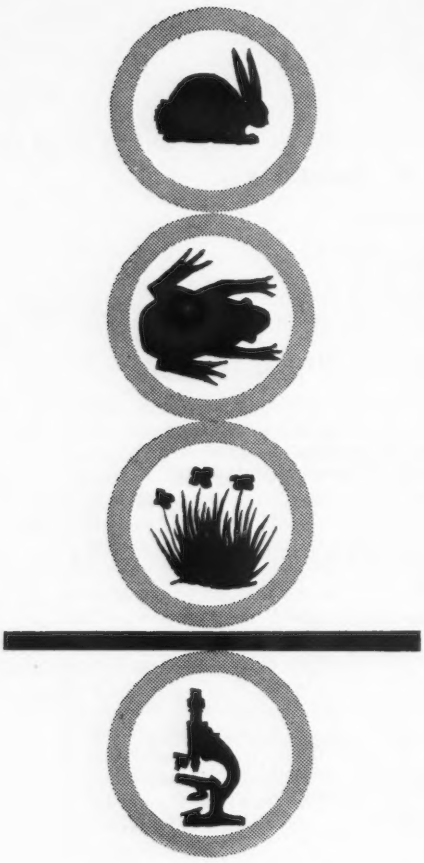

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By DALE C. BRAUNGART, Ph.D., Associate Professor of Biology, The Catholic University of America, Washington, D.C. New, 1959, 5th edition, 256 pages, 7¾" x 10½", illustrated. Price, $3.50.

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By DALE C. BRAUNGART, Ph.D., Associate Professor of Biology, The Catholic University of America, Washington, D.C.; and RITA BUDDEKE, S.N.D., M.A. Just published. 1960, 5th edition, 416 pages, 6¾" x 9¾," 213 figures. Price, $6.25.

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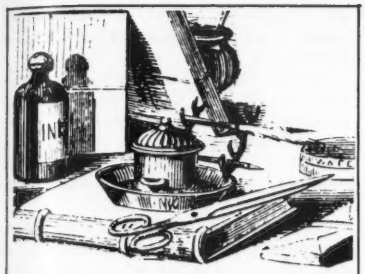

LETTERS

There was a news release April 26 throughout the press in the United States, a rather lengthy article regarding a research fund to be called the "Bartlett Memorial Exploration Fund" which is to be created in honor of the late Professor of Botany Harley H. Bartlett. The account states that the fund is to be administered by the Institute for Regional Exploration of which Ted Bank is Director.

I wish to point out that there is a fund established at the University of Michigan in 1955 at the time of Professor Bartlett's retirement which is officially set up in the Accounting Department of the University entitled the *Harley H. Bartlett Plant Exploration Fund.* It continues to be supported by his former students, friends, and colleagues. Grants have been made every summer since 1955 to support the field expenses of promising undergraduate students in Botany and beginning graduate students.

I am not certain of the nature or aims of the Institute for Regional Exploration, but it should be made clear that it has no connection with the University of Michigan and that its proposed "Bartlett Memorial Exploration Fund" is in no way to be confused with the fund established and supported by the botanists of the University.

K. L. Jones
Chairman, Department of Botany
University of Michigan
Ann Arbor

In his amusing response to Fred R. Cagle's blast against the multiplication of journals W. F. Hollander suggests yet another publication in science: "a special huge pulp-paper journal to take papers which editors don't like." I should like to enter my subscription to this journal, providing yearly cost does not exceed $49.98. If one can believe the editors, papers are rejected for two major reasons: first, they are poorly written; second, the scientific data are no damned good. This new journal will be a never ending source of delight. Since the death of the "foreign" comedian on radio and TV, mangling of the language has ceased to enrich our lives with its humor. If what the editors actually publish are examples of "good" English, what they reject on this basis must contain frequent gems of wit. Many rejected papers are, no doubt, written by persons on the idiot fringe of science and would, like the grave-diggers in Hamlet, provide comic relief for the rigors of scientific research.

In addition, this journal is likely to contain one other class of papers, since editors judge scientific worth on credibility and papers are rejected on the basis of their being incredible. The really exciting papers will fill our pulp-paper journal, side-by-side with the trash, for really new ideas are always incredible.

Richard A. Edgren
Division of Biological Research
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P.S. Will someone please send me the address of the Managing Editor of this journal as soon as it is established?

Many biologists have expressed concern over the vast and rapidly increasing published literature and the growing difficulty of recovering information thus recorded. Dr. Fred Cagle ("Increase of Biological Serials—a Destructive Trend?" *AIBS Bull.*, Feb. 1960) in discussing this problem has presented arguments for a drastic reduction in numbers of biological serials by consolidation. I feel that a great number of biologists and the progress of biological science would be adversely affected by such changes and that the disadvantages need to be pointed out.

The tremendous number of biological serials that have come into existence is a reflection of the tremendous natural diversity of living things and their modes of life. It is unfortunate that this great diversity of subject matter and research interest has produced a burden for the librarians, editors, and research workers themselves. However, it would be folly to attempt to solve this problem by strangling all the little serials that are troublesome to look up.

Cagle has listed and answered some major objections to consolidation of serials but he omits the basic and overriding reason for their existence: their subscribers want and are willing to pay for the articles published in many small serials, but they could not and would not pay the far greater costs of subscribing to behemoth

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journals containing only a small fraction of material of interest to them.

Far from being a destructive trend, the creation of new serials is a healthy sign that new approaches and interests in the complexities and interrelationships of living things are being encouraged and given opportunity for expression. Those interested in these new areas of publication are given the opportunity to subscribe to such papers at nominal cost without burdening their shelves with bulky and expensive tomes they will never read.

It appears that Cagle has weighed this problem primarily from the standpoint of the library administrator and the professional biologist who relies almost entirely on a large institutional library. It would be interesting to know what percentage of constructive writing in biology is done by such workers. Regardless of the percentage, it can hardly be a wise practice to penalize enthusiastic amateurs and less favorably placed professional biologists for the possible convenience of those with ample library support. It seems to me the latter are the ones best able to cope with some inconvenience and to apply technical advances to alleviate the problem.

Cagle asks "Why not a single journal for the museums?" Surely he would not expect all the present recipients of such diverse museum serials as *Bulletin of the American Museum of Natural History, American Museum Novitates, Natural History, Memoirs of the Carnegie Museum, Proceedings of the U.S. National Museum, Museum News,* and *Museum Pictorial,* to name but a few, to subscribe to a single publication of such bulky and varied content. If so, what editor or board of editors could satisfy the divergent interests of such readers and get out the issues in anything near the time now met by these separate serials? And how many would pay the price?

As for a single journal for the universities, to whom would he entrust the tremendous dictatorial powers that the editors of such a publication would exert over the entire academic profession? University politics as now practiced by too many biologists would be child's play compared to the pressures exerted under such a consolidated system.

I am sure that thousands of biologists employed in the many departments and laboratories of the federal government would throw up their hands in horror at the prospect of trying to get their results published through a single governmental journal. The presently common editorial delays and mishandling that sometimes stretch into years from the date of submission would be compounded under a single bureaucratic board of editors.

Of the numerous supposed destructive results of the "tidal wave of publication" listed by Cagle, most are in fact basic deficiencies in the training, interests, and competence of biologists. Consider, for instance, the narrowing of special fields with increase in journals. It is a moot question whether this is a harmful trend at all. Most biologists of my acquaintance have some "narrow" journals and some "wide" ones on their shelves. The failure of many specialists to be aware of pertinent knowledge in related fields is due primarily to their own training and interests, not the nature of publications. The person who is interested in unifying concepts in biology has no difficulty in finding significant new writings of this nature. And the biologist who is interested only in his own specialty will not read anything else even if it all comes together under one cover. One cannot make a political scientist out of a sports fan by mailing him the New York Times. *Robert B. Finley, Jr., Denver Wildlife Research Center.*

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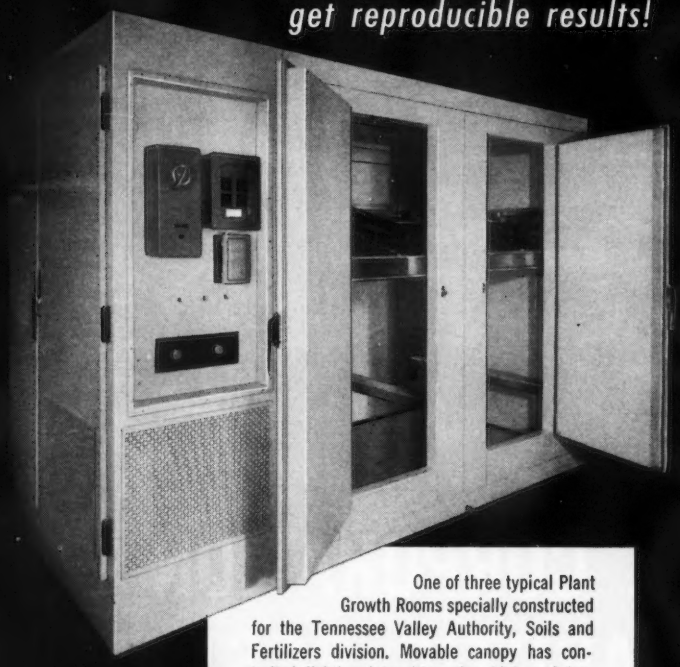

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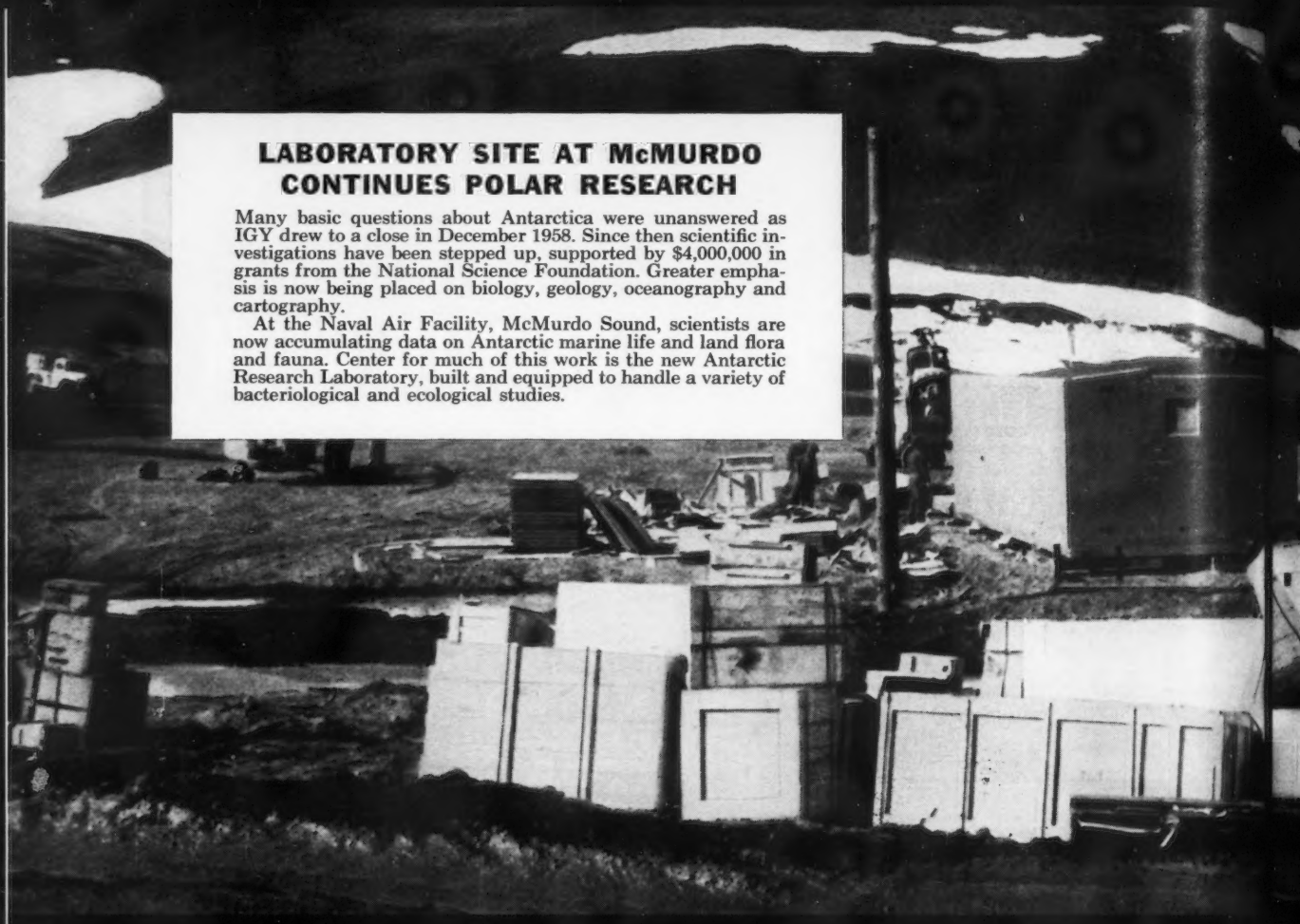

LABORATORY SITE AT McMURDO CONTINUES POLAR RESEARCH

Many basic questions about Antarctica were unanswered as IGY drew to a close in December 1958. Since then scientific investigations have been stepped up, supported by $4,000,000 in grants from the National Science Foundation. Greater emphasis is now being placed on biology, geology, oceanography and cartography.

At the Naval Air Facility, McMurdo Sound, scientists are now accumulating data on Antarctic marine life and land flora and fauna. Center for much of this work is the new Antarctic Research Laboratory, built and equipped to handle a variety of bacteriological and ecological studies.

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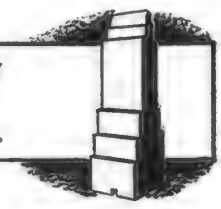

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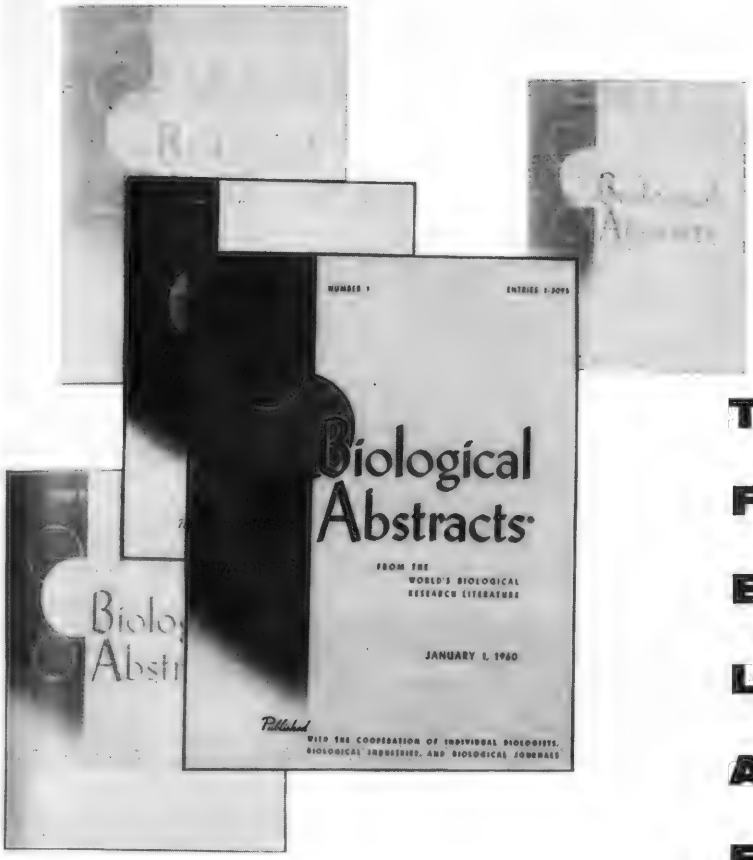

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EDITORIAL

The Broken Record

In late March the Civil Service Commission announced "that minimum pay rates for engineering and certain kinds of physical science positions will be raised to the top of grades GS5 and 7." These salary increases, averaging about 10%, apply to new employees as well as present job holders. All engineering positions in these grades and seventeen "scientist" categories are affected. No biological specialty is included, but landscape architects, patent examiners and patent advisers, for example, get a healthy pay raise. If you have a nagging feeling you've heard this story before, you're right—about two years ago. Then, the AIBS objected strenuously and loudly and some redress was made during the following year. The AIBS will speak up again, but complaining about what we consider is unjust discrimination against biologists, no matter how effective we may be, is not the real answer. The actions we feel we must deplore should not have to be taken in the first place.

By law the Civil Service Commission may raise salaries "within . . . pay grades when the Government is at a competitive disadvantage with private employers and the Federal need is acute." In a competitive society, which few if any would want changed, the Government has acted properly to re-establish its own competitive position in acquiring and retaining scientific talent. But the clear fact remains that biologists in Federal employ have been discriminated against once more.

Clearing out the underbrush of "scientist-engineer acceptance ratio" federalese jargon, the facts are that the Government last year was able to hire only 1 out of 3 engineers interviewed and only 2 out of 5 in the other categories. It had considerable less trouble recruiting biologists. Obviously biologists do not command the 10% higher salary in industrial or academic work and the government enjoys a competitive advantage and does not find that "the Federal need is acute."

Are not we biologists responsible for this situation which apparently is to be repeated every so often? Have we impressed upon a competitive society the value to that society of our work? Have we told forcefully enough and often enough the immeasurable debt our culture owes to biologists and to the science of biology? Do we even want to? Or have we been so busy with creative work that it has never occurred to us? A sister organization to the AIBS in another scientific discipline for a number of years has operated a "public information" service. The efficacy of this service is evidenced in part by the fact that Government consistently is at a "competitive disadvantage" in hiring our fellow scientists in that field. The society's members pay as part of their dues about $2.00 per member per year to support their public information service. Annual cost of the service is about seven times the total in dues paid to the AIBS. The organizations are about the same size.

The AIBS Board of Governors authorized the AIBS to set up a Biology News Bureau at last August's annual meeting. The Bureau now is a reality and already is having an impact upon press media in providing responsible reporting and thoughtful interpretation of news of biology. This is only a feeble start, however. Financed by funds other than dues to the AIBS, its budget amounts to less than thirty cents a year per biologist. Nonetheless, it may be the beginning of an effort by biologists to crawl from under their self-imposed bushel basket.

HIDEN T. COX

Thoughts entertained on the 100th anniversary of the publication of Darwin's "Origin of Species by Natural Selection"

Max Hamburgh

Department of Anatomy, Albert Einstein College of Medicine, Yeshiva University, New York City

A Biologist's Reflections on History

Part I

THE STUDENT of biology who in his spasmodic attempts to keep up with the progress of the humanities makes an excursion into the field of history is struck by the similarity between the language and concepts of his own discipline and various current interpretations of history. On second thought, perhaps he should not be surprised. Why should historians, in their efforts to interpret the rise and fall of civilizations, not have recourse to the ideas and models provided by a science, like biology, which is faced with the apparently analogous task of explaining the progressive change of forms which life has undergone on this planet?

Until as late as the closing years of the 19th century, history limited itself essentially to the recording of past events. Depending upon one's own personal religious or moral preferences, the record of the past seemed to reflect either progress toward a divinely imposed goal or, later on, just "progress" per se. In this respect, history somewhat resembled the state and attitude of pre-Darwinian taxonomy and comparative anatomy which had recorded in minute detail observations of form and structure of as many living organisms as were available without providing any key whatever for explaining the similarities or differences existing between them. By contrast, the 20th century has witnessed, a series of efforts by historians like Spengler and Toynbee to subject the vast amount of uncovered historical facts and fancy to a rational or speculative analysis. Like Darwin, Lamarck and DeVries in biology, these men and others influenced by them, proceeded to suggest explanatory schemes for making sense of the vast amount of archivistic data accumulated by generations of chroniclers. Toynbee tells us that all civilizations are essentially similar in that each undergoes a definite and closely comparable life-cycle initiated by specific responses to specifically adverse stimuli or challenges. After that, they either undergo growth and differentiation or they are "arrested" in their growth, such as the Spartan or Polynesian civilizations. Arrested or "stagnant" civilizations will be superseded by new civilizations if in the process of meeting the original challenge they have become so specialized that they cannot successfully rise to meet new challenges by new and more appropriate responses. Prior to Toynbee, Spengler had supported his historical prophesies by speaking of the birth, growth, youth, adulthood, senility and decline of cultures.

The most striking aspect of both these divergent interpretations of history is their common reliance upon models borrowed from disciplines dealing with the phenomena of organic life. We may frown or express reservation at the uncritical use of concepts such as growth, differentiation, maturation, response or stimulus which are more and more frequently employed by historians or social scientists. The biologist himself is still struggling to define these terms operationally, justifying their use in the meantime wherever their employment makes for descriptive or explanatory clarity.

Still, I suppose biologists are in basic sympathy with their colleagues of the history department, not only because their professional egos are collectively flattered by such imitation, but also because they are in accord with the basic premise of the biological approach to history. This basic premise can perhaps be expressed briefly as the assumption that the creation of civilizations, as part of the creative activities of a group of rather remarkable "living beings," must be akin to other expressions of life-activities and thus subject to laws and regularities which may be analogous to the many forms and functions by which we understand life.

The unsatisfactory state of modern "universal history" may well be comparable to the impasse to which biologists of the early 20th century came when they realized that the continued search for ever more links to close the gaps between apparently related species could not by itself prove the theory of evolution. It fell to the science of genetics to propose the mechanism through which evolution appears to operate.

It is, therefore, the thesis of this paper that if the models and concepts derived from organic life-sciences in general and the theory of evolution in particular have proved of value to historical thought, then some of the more recent concepts developed by the science of genetics may be even more to the point and thus deserving of some attention by the historian.

Part II

In bare outline, the mechanism of evolution as seen by the geneticist runs as follows: Mutations, or changes in the gene material, arise in every animal species with a certain finite frequency and thus supply the raw material for evolution. Most mutations, being accidents of nature, are more likely to be deleterious than beneficial at the time they occur. They may cause a change in the structure of one of the organs, or they may simply change the rate of a physiological process, rendering the affected organism more susceptible to disease or metabolic failure. Some mutations may affect the coloration of all or some external parts of the body (skin, eye color, hair color), others may affect the size, shape or structure of body-parts (cleft palate, hydrocephalus), while still others may just affect purely physiological reactions, like irritability, rate of metabolism or glandular secretion (hemophilia, Parkinsonism, pituitary dwarfism). But while most mutations, because of their deleterious effects, would be expected to be lost by simply impairing the afflicted animals in their competition with healthier members of the species, they have a way of being maintained and perpetuated in the population. This is probably due to the circumstance that newly mutated genes are usually not permitted to express themselves in the presence of the homologous older normal gene on the other chromosome of the pair. This relationship is referred to among geneticists as "recessivity," a term denoting the fact that genes are present in each cell in *pairs*, and if one of the pair changes (i.e. mutates) the other unchanged member of the pair as a rule still exerts the dominant influence. The majority of the so-called "visible mutants" resulting from the random union of two mutated genes, can at best give us an inkling of the far higher frequency of the number of such mutated genes present, though hidden, in the population by virtue of their recessivity.

Ultimately however the success or failure of a gene to maintain itself in a population depends upon the "selective" action of the environment to which all biological variations are exposed. The more "fit" genes survive in greater numbers than the less "fit." It is important to realize however that fitness is defined in terms of the environment. There is no such thing as fitness per se. In the regions of Africa where it lives, the giraffe with long legs and a long neck is more fit than a stubbier giraffe. If the giraffe were transported to the arctic tundra, where all food grows within a few inches of the ground, its great height would no longer make it more fit, but rather less so. Fitness then of a gene or its mutated allele is a property conveyed upon it by the environment. It is a value as changeable as the environment itself.

The essentials of the relationship between environment and biological variants was first proposed in scientifically acceptable form by Charles Darwin in 1859 in his *Origin of Species by Natural Selection*. His theory of selection can be reduced to the simple logical proposition "that those variants which are better adapted to their environment will reproduce in greater numbers" than their less favored contemporaries. Darwin's theory of natural selection is really no theory at all. It is merely a statement of the observation that some organisms survive and others do not. The theory gives us no information as to how some organisms persist and others fail to do so.

It fell to the science of genetics to provide the explanation of the mechanism through which evolution operates. This new theory which supplements Darwin's is called by T. Huxley: "Evolution, the modern synthesis" and it was formulated mainly by the insights and in the language of modern genetics.

Evolution, then, may be conceived of as a resultant between two fundamental biological phenomena.

a) The raw material of evolution is provided by a discrete number of accidents (mutations) which presumably occur during gene reduplication. Each results in ever so slight changes in the germ plasm, which in their totality give rise to the whole store of biological variations.

b) The direction of evolution is determined by the environmental situation within which the organism has to accomodate itself. In biology we have come to personalize this "tete a tete" between a biological population and its environment by referring to it as "Natural Selection." Natural Selection however is not an all or none proposition. Unlike "artificial selection" as practiced by a breeder, natural selection is merely a difference of survival of competing genotypes, and often this difference is exceedingly slight.

But the "bad" genes of today may become the most desirable genes in the changed environment of tomorrow. It would be nice if organisms were able to respond to the changes of its environment by producing only the proper genetic alterations when needed. Nature however has hit upon a different solution. Instead of discarding the accidents which happen during the difficult process of gene duplication (i.e. mutations), it preserves them, shielded by the protective cover of recessivity, for future use. The greater the genetic variability produced in this manner within species, the greater the choice of switches into which a species can be directed in response to changing environments.

The risks are obvious. By allowing possibly deleterious mutations to "hide behind" the dominant "normal" allele, and thus protecting them from total extinction, a species population may accumulate an ever-growing number of deleterious genes.

It is a gamble, but a gamble which apparently must be taken.

A few examples taken from observations of microbiology, paleontology and anthropology may illustrate the point.

If a population of bacteria like Escherichia coli (the ordinary symbiont type inhabiting the colon of men) is cultured in the presence of the mold Penicillium or Streptomyces, multiplication of the cells in the culture will soon cease, and all the members of the bacterial

population will die. Occasionally a bacterial cell survives despite the presence of such actinomycetes. From such a survivor a new strain of bacteria may develop which may be completely resistant to the bactericidal substance produced by the mold. These observations may be interpreted in one of two ways. One might account for the change by assuming that the presence of Penicillium itself induced the mutation to resistance or at least accelerated it.

The alternate hypothesis explains the change by assuming that mutations conveying resistance to Penicillium have occurred in bacteria from time to time regardless of whether the strain was exposed to the mold or not. In the absence of the mold the resistant mutants have held no advantage over the ancestral susceptible form. They may even have a slight disadvantage, because the same gene responsible for resistance may have other yet unknown side effects.

When exposed to penicillin the obvious happens: All the susceptible cells succumb, leaving only the few of the randomly arisen resistant mutants to survive and reproduce, thus transforming the original susceptible strain into a resistant one.

The genetic reinterpretation of Darwinism has thus given an explanation of evolution so that it can now actually be "repeated in the test tube," as the example from microbiology illustrates. The new gentic synthesis of evolution has provided also the key by which the transformations of species and their descent from one another as recorded in the paleontological past, can rationally be fitted together.

Although the paleontological record presents us with remains in which only abrupt and discontinuous changes are observable, most students of the fossil record agree that these changes must have been preceded by a slow and gradual accumulation of morphological variants, which though invisible to the paleontologist, were nevertheless real.

The construction of the fleshy lobed fin, which enable certain crossopterygian fishes to seek terrestrial surroundings, must have been preceded by an accumulation of a fantastic number of mutated genes at a time when any deviation from a primarily fin ray type could only have been disadvantageous.

The simultaneous accumulation in those fishes of a large block of mutated genes, which in their additive effect resulted in a saclike outpocketing from the gut, the lung, which could serve for exchange of gases from the air, rather than of gases dissolved in water, as is the customary situation in gills, gave the crossopterygian fishes their unique advantage during the severe droughts of the Devonian period.

A final example from anthropology. Like other plant or animal species Homo sapiens has diverged genetically in the several environments in which different human groups have come to settle. However, unlike other animal species, the isolation between these groups was never complete enough to prohibit interbreeding and therefore free gene flow. As a result, the accumulation of gentic differences was never of a sufficient magnitude to allow species separation in "Homo sapiens." But the different environments selected different genes giving rise to at least five distinct racial types, distinguished by the frequency with which certain genes are present in their population.

We do not know why it might be better to have frizzy hair if one lives in Africa. But we know at least something about the value of one of the most obvious and dramatic racial characteristics in man, the presence and quantitative distribution of pigment cells. It is evident that in an environment where sunshine is intense and prolonged the presence of cells in the skin endowed with an enzyme system capable of synthesizing pigment granules in response to exposure to the rays of the ultraviolet spectrum is of considerable advantage. It is reasonable to assume then that in the native population of Africa the frequency of all those genes directing the differentiation of a large number of pigment cells would be far greater than in the nordic population of Scandinavia.

In Africa, therefore, a block of genes assuring heavy pigment production in the skin at all times has been selected for, while in more temperate climates characterized by seasonal variation, a more plastic pigment setup is established where the pigment forming reaction is started upon exposure to the sun's spectrum and lost in its absence.

The fundamental difference between this and the Lamarckian scheme (according to which organisms invent new structures and modes of functioning in direct, adaptive responses to change) often escapes those unfamiliar with contemporary genetics. The genetic interpretation has indeed made short shrift of the teleological argument popularized by Lamarck. Life, or living organisms, do not deliberately and purposefully respond to external stimuli by modifying themselves into structures more capable of meeting new situations, in the way that a corporation may attempt to meet the pressure of rising competition by reshuffling its table of organization. Actually, if some changes occur in nature in this way they can be shown only to be transitory. Thus, to quote one classic experiment, Weissmann cut off a great many mouse tails without ever succeeding to produce a race of tail-less mice.

If one insists on looking for "purpose in life," one might as well be satisfied with the realization that "life" appears to anticipate a whole set of possible conditions which may or may not arise and that "it" gets ready for them by making the necessary provisions by way of genetic "freaks" which, if not of much use at one time, may touch off the most useful genetic re-groupings at dramatic periods of large-scale environmental change. To put the matter paradoxically, it is only the freak who has a future and the blessings of the fully "adjusted" organism cannot last longer than the context within which they are studied.

Part III

Such being the genetic side of the modern story of evolution, can biology in its most advanced version offer as suggestive a model for interpreting historical processes as it did in its earlier Lamarckian version? In the present paper, we will not concern ourselves with Spengler who proposed that civilizations or cultures be conceived as organisms undergoing youth, maturity and unavoidable decline and death. Suggestive as many of the conclusions which Spengler has drawn from this thesis may be, a growing number of

historians have found it ever more difficult to overlook the rather far-reaching difference between organism and society upon which Spengler's thesis is erected. Instead we shall turn to a more recent "Study of History," namely Toynbee's conception of a "society-civilization."

Toynbee's conception of history resembles Spengler's with civilizations going through the same cycles. He differs from Spengler in denying that this process is predetermined.

But the essential outlines of the process, namely the birth of a civilization, its growth and differentiation and its subsequent failure to adjust to a new challenge, leading to its subsequent breakdown, have been repeated according to Toynbee 21 times throughout recorded history. Only five of these civilizations are listed as surviving, in the sense that they have not yet reached the stage of inner breakdown, though a number of them seem to be approaching their own destruction rather rapidly. These survivors include: the Western, the Hindu, the Islamic, the Far Eastern and the Orthodox Byzantine civilizations. The list of the less fortunate victims includes: the Egyptiac, the Andean, the Sinic, the Minoan, the Sumeric, the Mayan, the Yucatec, the Mexic, the Hittite, the Syriac, the Babylonic and the Hellenic.

The genesis of each of these civilizations is conceived by Toynbee as the outcome of a unique, rather heroic group response of a community to the challenge of fairly difficult, unpleasant and unusual situations. Often the adverse stimulus is provided by the terrain, such as the barrenness of the land which started Minoan and Hellenic cultures.

A more recent example of terrain directing the birth of a nation may be the experience and efforts of a group of Puritan refugees who settled along the coast of New England 300 years ago.

Other effective challenges which can organize a herd of people into a community able to master its surroundings and assure its collective survival are: pressures from outside enemies, such as was experienced by the Iberian Christians from their neighbors the Moors; penalization such as was applied to the Jews of the Diaspora. Even slavery has provided adequate challenges with creative consequences.

Once established, a new community will have to add something to its bag of tricks in addition to whatever new inventions were responsible for it emerging successfully in the first place. The conquest over its adversaries, whether in the form of an outside oppressor, enemy or just rough terrain, must be followed by less dramatic accomplishments of building a state, a society or a way of group living. A community must make arrangements to assure its continued existence by organizing itself, making laws, writing constitutions, setting up governments and establishing rules of conduct and norms of action. This phase of the life cycle of a civilization is designated by Toynbee as its "Growth and Differentiation."

Growth and differentiation is dependent on the emergence of what Toynbee calls the "creative minorities," who must come up with the ideas by which to shape governments, strategies, social contracts, codes of laws and ethics.

The emergence of a multiplicity of voices in the form of creative minorities should endow the community with a polymorphism of its own which would guarantee that new solutions can be found to meet new challenges if and when they present themselves.

Unfortunately, on that score the record of history Toynbee recites is not too reassuring. The leaders who successfully responded to one challenge are rarely the successful respondents to the next. Those who have succeeded once are apt on the next occasion to be found resting on their oars.

While this brief paragraph certainly does not adequately state Toynbee's thesis, it may suffice to convey the similarity of his conception of a "society-civilization" with the biological "species population."

However, the biological parallel is to Lamarck, not Darwin, and not to the evolutionary synthesis as formulated by the science of genetics.

Part IV

In what follows I should like to suggest in the roughest outline how historians might bring their biological model-thinking up to date. The first thing that would become apparent is that questions of absolute origin, or of first "causes" of ancestral civilizations would continue to elude our methods. As of now, biology cannot satisfactorily answer the question of how life ever got started, but it can both describe and explain how subsequent life-forms connect up with previous ones. Analogously, we may be able to explain how successor-civilizations succeeded where their predecessors failed. What we cannot explain is why man, at one particular time, should have become a culture-building animal. Not that there is any scarcity of speculation on such matters which have intrigued and continue to intrigue man's imagination though his available knowledge is not yet equipped to satisfy his curiosity on this point respectably.

In biology we have learned to live with this limitation ever since Pasteur's experiment proved rather conclusively that there is no such thing as "spontaneous generation" and that all living things come from previous living things.

With the issue of the "first" origin of cultural organizations shelved, how can we account for their survival or adaptation to an ever-changing environment? If culture-change is not clarified in the direct teleological Lamarckian fashion, perhaps on the social level there takes place some sort of "cultural selection" of social mutants? Just as a biological species prepares itself against a variety of unpleasant and possibly lethal external changes by permitting in its population a pool of randomly mutated genes (fit to meet such emergencies), so perhaps each society must harbor in its midst its own contingent of "mutants" or "irregulars," called respectively freaks, misfits, deviants, radicals or non-conformists.

Now, the existence of such non-conforming minorities within the framework of any existing (and past) society is surely not a new discovery. Their role in all sorts of historical processes has intrigued the biographically-inclined historian as much as it has aroused those of the "historical materialist" school of thought. The former contend that all of history is but the product of the non-conformist hero or "great

personality" who imposed his or her visions upon the human multitude. According to the historical determinists, on the other hand, the "great men" function merely as the mouthpieces of social forces, at best riding the crest of a wave which they delude themselves to thinking they have personally created. The historical materialists are quite content to surmise that if Isaac Newton had never lived to see that legendary apple fall off the tree, some other British gentleman would have sooner or later observed some other fruit's descent from some other tree or arrived at similar conclusions by some analogous observations.

To evaluate properly the nature of the relationship between the individual and the non-conforming minorities on the one hand, and the social forces which interact with them in producing changed patterns of group living, on the other, we must not be misled by focusing too sharply upon such minorities as proved to be of major historical significance.

"Many are called but few are chosen." The ones who are "chosen," however, as carriers of new life-patterns, be they organic or social, turn out to be those who appear as "deviants" in the old patterns of (natural or social) environmental adjustment. In biological terminology, the non-adjusted individuals might be called "social mutants."

Having established the existence of a fair sized potential stock of "social mutants" we must turn our attention to two questions: 1) What manner of circumstances is involved in creating such social mutants and 2) What forces determine their eventual success or failure in shaping historical events to their liking? The answer to both of these questions is, "We do not know." The question as to why some members of a social order are always prevented from finding their peculiar needs gratified within the arrangements permissible at given times and places is as fascinating and unanswerable as the question about the nature of the processes leading to gene mutations. All we know of the latter is that they happen continuously and spontaneously and that under certain conditions, such as radiation, e.g., they will occur with sharply increased frequency. In other words, mutations are accidents and accidents happen. Analogously, we have not yet hit upon a satisfactory theory which would explain the chain of events by which an individual is alienated from his group within which he was nourished. In the absence of confirmable theory, there is, of course, speculation. Thus we are told that a sudden and miraculous enlightenment on the road to Damascus changed Paul of Tarsus from a leading member of the Jewish upper-upper class to a converted and converting hermit in the Arabian desert. The sacking of Kapilavastu presumably so impressed the young aristocrat Siddharta Gautama that he renounced a world which appeared to become inhospitable to aristocrats and he thus was motivated to attempt withdrawal as a new and better form of life. Eloquent and powerful as are the figures of Paulus and Buddha, of Moses, Jesus, Mohammed, St. Augustine, Luther, Cromwell, Herzl, Lenin, Marx and Gandhi, of ultimately even greater significance is perhaps the less eloquent band of apostles, disciples, fighters and martyrs which make up the nucleus of the "great man's" effectiveness. If the great and lonely figures which lead into the future are the "macro-mutations," then the small minority, forming their initial followers, could be called the micro-mutable material. They form that strange collection of misfits, cranks, visionaries, impractical idealists and dreamers to whom perhaps Christ addressed himself when he said: "Thou art the salt of the earth and the leaven that makes the dough."

As regards the second question, we must profess an equal measure of ignorance.

The analogy to biology here is to the formula established for selection. Just as there are selective forces operating in biological speciation, "quasi-selective forces" might be at work in history.

In more articulate language, "selection" in an historical sense implies that under a different set of conditions, i.e., under a slightly different constellation of outside factors to which culture patterns are required to respond, the influence of a great personality or the outcome of a given historical adventure or movement might have either failed, or succeeded or taken on an entirely different direction from the one it actually did take.

We are told that the Roman Empire, during the long period of its decline, was fertile of large crops of prophets, Messiahs and other imports from the East, and the "Christians" were only one and, for some time, not even the most notable among others. One wonders whether the conversion of the Near Eastern population to Christianity which was just one of the many messianic sects flourishing at that time would have been as successful if the road system of the Roman Empire had been laid out less well. Fifteen hundred years later bids for religious change (and "salvation") were again advanced by such individuals and minority groups as the Waldigensers, Hussites, and Calvin, all of whom were of either small or of no major historical significance, but the Saxon monk Luther succeeded where they failed and brought on the "Reformation."

From among all sorts of proposed alternatives to "private enterprise" it was the bolshevists who carried the day and initiated a revolution, the end of which is not yet in sight. But communism as a way of living and organizing society and distributing goods has been proposed since time immemorial. Recall the Jewish Caldaeans, the followers of Christ, the Franciscan monks, the Utopian cooperatives in North America. None of these succeeded in setting up for any length of time a stable community in which property was owned collectively. Why were the bolshevists able to succeed where so many of their illustrious predccessors met only failure and frustration? Is the rise of constitutional government sufficiently explained by reference to English "genius" or "character," composed presumably of the hereditary material of Danish, Saxon and Norman "genius," none of which, however, in its own environment could foreshadow the kind of contractual relationship between crown and subjects eventually established by the Magna Carta in Runnymede in 1215. Perhaps similiar aspirations entertained by some potential "rebels" of other nations did not find the same set of circumstances on the feudally organized continent to make such contract between King and nobles appealing and their ambitions ended, instead of in Parliament, at the Bastille.

Part V

To many historians the ultimate decline of practically all known civilizations points up better than any other factor the resemblance to organic life. No matter how triumphant a people's history and civilization, the ultimate fate of extinction and defeat is shared by all. So, at least, says Toynbee.

The similarity to biological laws is obvious—does not the story of paleontology reflect the coming and going of one species after another, much like history records the rise and defeat of different civilizations?

But is extinction really in the cards for each and every civilization? Is Western civilization, in particular, approaching its "decline" or final agony, or its passage into a technologically monolithic power-structure as foreshadowed by new departures from Western norms in both the USSR and China? This question, if not answered, is raised again and again by serious-minded historians, taking their cue either from Spengler's earlier and gloomy prognosis for the "occident" or from Toynbee's detached recounting of all history as a series of unsuccessful civilizational attempts to respond adequately to the ever-changing challenges of natural and social circumstances. Civilization's ball game with destiny scores a measly 21 to 5, according to Toynbee. Statistically this is indeed somewhat less than a good omen for the present.

Fortunately the biologists can provide a more cheerful outlook. Few biologists will quarrel with the belief that all living organisms have limited life-spans, *but no biologist is in possession of evidence which can be used for a proof that what holds for the individual organism must hold for the species.* Many species, to be sure, have come and gone, but others have been around for a long time and their careers, if limited in the cosmological end, may have futures of as many millions of years as their past. By contrast, the human species, whether ultimately limited or not, has hardly *started,* instead of *declining* towards its "inevitable death." Thus, while death is a fact of life, there is nothing in evolutionary theory to indicate that extinction is the final end to which all evolution is mysteriously directed by some unfathomable power. Quite to the contrary, there appears on the time scale of biological evolution a large number of "Methuselahs" who seem to be strangely immune to extinction. Among the invertebrates particularly we have in the sea-shell "Lingula" an organization which is still amazingly like what it was 400 million years ago. The silica-secreting radiolaria are claimed to have existed since the Cambrian. An oyster of 200,000,000 years or more in the past would look quite familiar if served in a restaurant today. Among the vertebrate immortals, the reptilian Sphenodon deserves a place of honor, just as the opossum which has survived unchanged since the Cretacious. The way to achieve or approach immortality, it seems, is to be fortunate in having made an early adaptation to an environment which does not ever change, or to be ready with new adaptations where environmental changes cease to favor earlier conditions.

The one fatal fallacy which some of the otherwise most successful species have committed was to make too perfect an adaptation. By sacrificing versatility for perfection they failed to adapt to new environments. To make too complete an adjustment—putting all one's eggs into one basket—appears to be as lethal a course to take, as to make no adjustment at all.

The sabertoothed tiger, appearing in the early Oligocene became extinct only yesterday, i.e., in the Pleistocene, some 20 or 30 million years ago. According to Simpson, the ever-lengthening saber-tooth of this beast started out as a perfectly effective biting mechanism until eventually it became an impeding and destructive occlusion. The antlers of the Irish elks, which originally were highly adaptive weapons for offense and defense in time became so cumbersome a burden that their owners were ultimately doomed before they had a chance to use them. "Study of History" is a storehouse of historical parallels to sabertoothed tigers and Irish elks.

The analogous fate of the knights in shining armour comes to mind. In the late Middle Ages they had perfected such all-protective "panzers" for themselves that, while shielded against blows and thrusts, they were also effectively imprisoned and immobilized and thus easy victims for more movable yeomen, fighting according to changing rules of combat.

The fate of the once-mighty Armada at the hands of the British pirate vessels is another case in point.

As the gist of all this, two lessons are respectfully offered to the historian: 1) The final agony of all dying civilizations is marked by the desperate attempt to meet a crisis by too rigid a code. For society, just as for biological species, the inability to change beyond already successful changes, is the most general cause to which all more specific causes of downfall can be reduced. Rigidity, conformity, inflexibility spell extinction for societies as well as for organisms. The liberal mind may take some comfort from the historical lesson that demands of absolute obedience and conformity repeatedly made by society upon its members in time of trouble and crisis have rarely, if ever, succeeded in overcoming the difficulties for the sake of which they were invoked. Imperial absolutism, the Inquisition, the police-state or fascist dictatorship, they all have a way of succumbing in the end. 2) Only the readiness to change offers promise of survival. Democracy as a form of government most likely to maximize change through multiple representation, may be defined as being itself one of the most potent, if not indispensable, social tools for providing optimal conditions for permitting and maximizing human diversity, filling the reservoir of social mutants whose presence and frequency co-varies with the success or failure of social organisms to meet unanticipated environmental changes from within or without. It is probably safe to say that given the correct momentum and frequency of change which instead of happening to man can now be produced by him in both deliberate and unforeseeable ways, there will be no society that can hope to survive without holding in readiness some of the "openness - to - change" which Western people attribute to democracy alone.

Making the most of individual ingenuity—a challenge that demands creativity in biological education

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Creativity, Biology, and Education

DURING THESE TIMES of turbulence and re-evaluation in the field of teaching, both biologists and educators are doing a great deal of thinking to the end that biology might be presented more effectively to the coming generations. Efforts are being widely made to increase the conceptual and quantitative content of the subject matter, to bring more up-to-date exercises into the teaching laboratory, and to reduce the time lag between the frontiers of knowledge and the classroom. Such efforts can be expected to increase the efficiency with which biological concepts, techniques, and terminology are transmitted to the student.

One can ask at this point to what end this increased efficiency is directed? Surely it will aid in producing a student body at any given level which is more erudite and with a more catholic grasp of biological principles. This is, of course, very well if one views biology just as a body of knowledge which is to be passed on in as broad and integrated a manner as possible. Within this view the student masters a large mass of fact, is told what the scientific method is, and has structure, process, or technique demonstrated to him in the laboratory.

It is noteworthy that within this conception of biology there is little time for a student to have more than fleeting twinges of curiosity about life phenomena or to experience the challenge of a real problem. He is much too occupied with the acquisition of a body of knowledge to taste the rewards that biology has to offer him as an individual.

The chance to create

Looking to other fields, one wonders how stimulating and productive any of the arts would be if taught in such a way that the student experienced only the results, techniques, and thinking of others without the chance to write, paint, or play an instrument on his own; how interesting mathematics would be if presented as a mass of theorems, techniques, and applications to be learned without opportunity to wrestle individually with problems along the way. Such an approach would obviously produce a barren erudition, the acquisition of which would be relatively painful.

But in the case of biology, is it fair to compare it, the most empirical of the natural sciences, with the various arts? It would seem to this author to be highly fair—even necessary to do so! This follows from the fact that biology too is more than a body of knowledge. It also is a dynamic field of human endeavor, rich in reward to the individual, containing many creative aspects. Unfortunately, biological training today usually gives the student no chance to sense this until he enters graduate school and begins the personal approach to a biological problem. It is true that the better teachers introduce the problems of biology *as* problems and often take time to explain the way in which an obstacle to knowledge has been overcome, but even this is not enough.

Let us abandon for the moment the concept of biology as simply a body of knowledge. Let us say that it is primarily a field of human endeavor which, it is true, has produced a body of knowledge both interesting and often practical. What, then, has this field of endeavor to offer the individual in the way of creative effort?

The opportunity to be curious

Biology, as any science, should be motivated largely by educated curiosity about natural phenomena. Motivation in a negative sense through the prod of impending examinations (or reviews toward advancement in the professional ranks) is not enough and when used exclusively has undesirable side effects. Curiosity does not just happen; one must have the *opportunity* to become aware of phenomena, the knowledge and orientation to appreciate them when seen. The scientific method of objective investigation then usually takes a familiar sequence. An experimental or theoretical approach is laid out, the necessary experiments and equipment are designed to test or verify, observations are made, data is analyzed and finally integrated into previous observations.

Of these various aspects of productive biology it should be noted that all steps except one provide opportunity, even necessity, for individual expression and ingenuity. The one step that can usually be regarded as non-creative in experimental or analytical procedure is that of observation and measurement. It is the reading of the scale, the taking of the picture, the weighing of the object that is turned over to the technician whenever possible because the routine involved is only routine. Yet unhappily, it is precisely in this area of observation and measurement that too many biology teaching laboratories exclusively dwell. Students are expected to observe the expected, master the method, turn the dials, or follow the recipe to produce the "desired" result. The very ideals of much laboratory teaching theory deliberately eliminates every creative vestige by means of the explicit direction, the organized procedure.

Viewed from this perspective, have we any right to wonder why more superior students do not find their way into graduate work in biology; why we sometimes become seduced by the techniques themselves, tending to neglect their reason for existence; why some published work in biology is unimaginative or routine? Is it possible that we are organizing such qualities as independence, imagination, or ingenuity out of existence in the name of efficiency?

If we accept the premise that biology is primarily a field of human endeavor, then breadth and detail of biological knowledge is desirable mainly as a base for productive achievement, not as an end in itself. Educators would, as a consequence, spend a little less time devising more palatable or efficient ways of transferring knowledge and spend some time making opportunities for students to experience life phenomena and to use the scientific method in understanding them. It would seem better, even for the casual student of biology, to come away with fewer facts and a more general appreciation of biology as an intellectual endeavor.

If the premise makes sense, then we are faced with the problems of implementing it. To this end let us consider first a viewpoint which is implicit in a great deal of teaching in biology. It holds that a student is not ready for research until he has mastered a substantial minimum of knowledge and technique. This must mean, of course, research into relatively advanced problems of unknown character because there is nothing difficult or awesome in the scientific method as applied to simple questions. Perhaps college teachers, especially, are too impressed with the infinitely complex nature of life phenomena at their more fundamental levels; the difficulty of extracting real information.

More significance in introductory courses

Probably high school biology teachers have been less concerned with actual advance, using more often the simple experiment on living organisms. It is relatively difficult, however, for high school or college teachers who are not actively involved in research to think of good problems which have biological significance. It is common knowledge, however, among biology teachers at both high school and college levels that students respond with great interest to the challenge of the unknown. The problem is not one of student imagination or energy; the problem is simply one of selection of good problems appropriate to their capabilities and to the facilities at hand. There is much to be gained in the endeavor beside new biological knowledge.

If student research has merit, the best place to introduce it would seem to be in the high school and freshman introductory courses. It is here that many students get their only taste of biology. In more advanced college level courses the actual frontiers of knowledge become more cleanly defined while views of research become more sophisticated. It is correspondingly more difficult to find simple problems on a large scale in the various specialties which do not require prohibitive amounts of instruction time as well as more expensive gadgetry and facilities. The most effective place then seems to be at elementary levels.

The success or failure of this approach would hinge squarely on the selection of problems or questions. Some general guidelines might be tentatively outlined here. For example, the problem might be such that, if offered directly to the student, it could be posed as a simple question. The answers should be obtainable by utilizing, as directly as possible, the living organism. Good questions might be so conceived that the student could best get an answer by imposing variables and making some sort of quantitative measurements. The answer should be referable to some generalized biological concept. One might, for example, ask how good some experimental diet is in comparison with a varied human diet as measured by the growth rate of cockroaches; how a scout of an ant colony communicates to others of the colony about the location of a food "find;" how the visible populations of one square yard of sunlit meadow respond when a situation of total shade is imposed upon it; how the rates of phototrophic movements in plants are related to the intensity or wavelength of light; how the rate of contractile vacuole activity in *Ameba dubia* is related to the salt concentration of the medium.

"Research" activity of this sort could be integrated into the more conventional program, involving only a small reduction in the usual exercises so that time is available for the student to come to grips with his problem. Individuality and independence in approach would be encouraged, the instructor assuming only an advisory role which would be flexible with respect to how much help a student would receive. The load on the teacher might well be reduced by having "research" discussions and progress reports with groups of students every two or three weeks instead of with individuals. Group effort applied to specific problems would be good experience, allowing the instructor to intervene even less in the students' endeavors. The matter of instructor participation is less important because the emphasis would be on what the student could do as an individual, not on what the instructor could do as a teacher. The effort would be to offer just the minimum of advice to get and keep a project going, remembering that necessity is the mother of resourcefulness as well as invention.

New techniques would follow

As experience with such a program accumulated, good problems would become more plentiful and a new species of laboratory manual would probably make its appearance. Alongside the outline in which explicit, step-by-step directions are given, such a manual might contain chapters on the essentials of electronic circuitry, simple chemical determinations, statistical methods, methods of data analysis and graphical presentation, lenses and microscopic measurements, glass working, etc.

It should be noted that a how-to-do-it manual of this sort need not delve into the use of the more complicated gadgetry of biological research. As a matter of fact, at least at the high school or college freshman level, it would seem wise *not* to pour too much money into completely prefabricated devices. Improvisation and technical design are of the essence of independent research, insuring a thorough knowledge of what each device can and cannot do. Crude, home-made gadgets, especially when made in response to a specific need, might be more beneficial to the student in the long run. What money is available might more profitably go into some basic shop tools, raw materials, and basic laboratory components.

An extreme range of student achievement could be expected within such a program if it were offered to all students of a class. Some students would pick the easiest problems and then never do enough to generate interest. On the other hand, some students would certainly become absorbed in their problems and a few might achieve really worthwhile results. Perhaps a problem might best be offered as an option, in lieu of other laboratory work, to interested or superior students. It would be weakness to deny the *opportunity* because of the fact that many students would not get a lot out of it. As with any student work which is essentially subjective in nature, such a program would be difficult to grade. A teacher saddled with the conception that a program is no better than its accessibility to grading, would not be interested in this approach. Those teachers, however, willing to grade principally on the other aspects of the course, could probably learn to enjoy this productive part of their classes. Undoubtedly these teachers would find broader areas of intellectual contact with their students and, in turn, be more stimulated by them.

National planning

The recent widening of interest in the quality of science teaching has indicated that many problems can be handled more effectively at the national level. There are, for example, several areas in which a national planning group could effectively aid a general approach as suggested here. First, a great deal of serious and experienced thinking might go into the kinds of problems suitable for beginning students. A panel composed of both research professionals and outstanding teachers could probably devise rather concrete guidelines for the selection of problems suitable for beginners with limited time and facilities. This function would not be easy if carefully done; its success could do much to funnel inexperienced enthusiasm into more interesting and significant channels.

Next there is the matter of motivation. It seems that some better incentives to biological endeavor might be promoted by national planning groups. For example, if a growing number of students undertook to solve problems in biology, some of the work would be superior. Might it not be interesting to have at least one serious journal devoted to research findings, junior grade? A paper submitted to a tough editorial board and finally appearing in a journal which would be widely read by people of his own age, would be one of the real satisfactions of biology as a creative endeavor. One might even suggest that if such a journal were international in character, many valuable aspects would be added at both the student and national level.

Another outlet for young, productive biologists might be made through the cooperation of state or national societies. If the state academies of science, the AAAS, or the AIBS would institute sections devoted exclusively to investigators within certain age limits, students could find wider outlets for their activities at the various meetings without competing with professionals. The advantages to the student in preparing and giving papers are obvious. There are other advantages which might also be expected. Biology as a whole would enter the lists of school activities in which student achievement is rewarded. Band, football, dramatics—all offer students a chance to productively express themselves in school life. With them, biology could offer chances to travel, to compete, to associate with others of the same interests. In similar manner biology might also become recognized, by at least a few students, as something more than just another curricular hurdle.

Then too there is the matter of the never ending search for talent. Not only would such an approach provide opportunity for development of this particular kind of talent, but to committees which must select students for scholarships, awards, or admissions, positive evidence of quality and achievement would be a most welcome addition.

Surely such a program would be good for biology as a whole if even a few students of any class experienced the satisfaction that comes with personal achievement in the fascinating world of intellectual adventure.

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An attempt was made to invite to this conference all the persons in the United States who were actively engaged in reasearch on sporulation, spore germination and the enzymes of spores. Also, persons were invited from Canada who were interested in spore cytology, as well as Mrs. Powell from Porton, England. The papers presented in this book are those given at the symposium together with the formal and informal discussions.

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Edited by: Ralph W. Brauer

This symposium was held in San Francisco, October 30 to November 2, 1956. It was sponsored jointly by the Atomic Energy Commission, the Office of Naval Research, the Bureau of Ships, and the Bureau of Medicine and Surgery, U.S. Department of the Navy, in collaboration with the American Institute of Biological Sciences.

Edited by Dr. Ralph W. Brauer of the United States Naval Laboratory, this volume contains authoritative presentations by more than 100 experts on what is known, what is conjectured, and what is unknown concerning the structure and inner workings of the largest single gland of the animal body. Amply illustrated, the book is divided into seven chapters, each chapter containing papers on a particular specialized field of study, with a general discussion on the subject by all participants at the end of each chapter.

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Edited by: Elizabeth Kelly

The symposium was sponsored by the Bioacoustics Laboratory of the University of Illinois and the Physiology Branch of the Office of Naval Research. It was held at Allerton Park, Monticello, Illinois, June 20–22, 1955 under the auspices of the American Institute of Biological Sciences.

The book contains papers and discussions on such subjects as: Acoustic Properties of Blood and its Components, by E. L. Carstensen and H. P. Schwan; Physical Aspects of High Amplitude Sound Phenomena, by W. L. Nyborg; Techniques Used in Ultrasonic Visualization of Soft Tissues, by D. H. Howry; The Indications and Contra-Indications for Ultrasonic Therapy in Medicine, by J. H. Aldes; Neurosonic Surgery, by W. J. Fry and F. J. Fry; Progress in the Techniques of Soft Tissue Examination by 15 MC Pulsed Ultrasound, by J. J. Wild and J. M. Reid; Some Examples of Ultrasonic Frequency Sensitive and Frequency Insensitive Biological Reactions, by Rene-Guy Busnel; A Forum on an Ultrasonic Method for Measuring the Velocity of Blood, by E. J. Baldes, W. R. Farrall, M. C. Haugen and J. F. Herrick.

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A request for suggestions toward making the Century 21 Exposition more scientifically meaningful

Harold F. Osborne

Director, Biology News Bureau, AIBS

Science and Century 21

BIOLOGY will have an unusual opportunity to serve the public, to display its own shining scutcheon and to advance the banners of all science during the summer of 1962 at the Century 21 Exposition in Seattle, Washington.

This world's fair—comparable in scope to the Brussels Exposition—has for its major purpose the depiction of the role of science in our civilization.

The federal government has appropriated $9,000,000 for a principal pavilion in which the world of science will display its esthetic treasures, its intellectual challenges and its tangible products.

This will be the first time that the U.S. Government has selected science to be the subject of its participation in an exhibition. It is, moreover, the first to ask scientists' assistance in determining content and focus of scientific displays. The emphasis of science in the exposition is to be a primary one. The Century 21 Exposition, of which the U.S. science exhibit will be a part, will differ from past fairs by not offering a review of man's progress, but, rather, an insight into his future; a portrait of his life in the 21st century. International exhibits of commerce, industry, arts and culture are proposed to demonstrate how men will live, work and play in the coming century. Shops and entertainment areas will augment these attractions. But the Science Exhibit in the federal pavilion will be dominant.

Herein appears to lie the possibility for bridging the gap between what the biological sciences are and what the public thinks they are, and perhaps a unique opportunity to impress youth with the significance of science.

The preliminary preparations have been underway for two years. The staff of the Century 21 Exposition, the Washington State Legislature, a National Science Planning Board of 23 distinguished scientists, and representatives of the Department of Commerce—the agency designated by the President to develop and make recommendations for federal participation—have contributed jointly and individually.

But ahead are problems of both a scientific and non-scientific character which must be solved if an authentic, integrated, challenging, informative and timely science exhibit is to be offered.

From consultation with representatives of the Exposition, there is no doubt in my mind that the principal need is to communicate method, meaning, background and significance to an audience which the planners estimate will move past a given point at a rate of one person per second.

This flow rate is predicated on an expected 8,000,000 visitors to the federal pavilion over a six-month period, and on an average time-per-visitior of about an hour in the entire U. S. Science Exhibit.

The sponsors are hopeful the exhibits will lure many patrons back for a longer, second visit after they have seen other parts of the 74-acre exposition grounds.

Specifications call for science displays which will make use of color, movement and spectator-involvement, to avoid the static and pedestrian conglommeration of a hobby show or a machinery exhibition.

It is perhaps conceivable that a push-button simulation of a Cape Canaveral launching can be arranged to be repeated at approximately the one-second interval. Perhaps Newton's Second Law of Motion or a cycloramic depiction of succeeding geological ages can be so presented. But can an ecological community, the principles of photosynthesis and energy transfer, the mystery of inheritance or the inter-relation of structure and function be condensed to flash-card form?

Still more to the point, can the complexity of living matter and life processes, the open-endedness of the biologists' approach and the question-asking nature of the scientific method be so compacted? These are important problems confronting the planners of the exhibit.

Philip M. Evans, Federal Commissioner, U.S. Science Exhibit, has selected Walter Dorwin Teague Associates as exhibit designers, and a team of architects—Minoru Yamasaki of Detroit, and Narramore, Bain, Brady and Johanson of Seattle—to handle the physical aspects of exhibit presentation, traffic-control and display housing.

He has called on scientific resources in government, private industry and the academic world to suggest both specific exhibit items and general ideas which can be put together with scientific integrity and within limits of budget and time.

At this writing, the planning is not frozen as to final scientific content. I am assured that exhibit ideas are welcomed from the world scientific community. I am hopeful that imaginative suggestions will be forthcoming in such quantity and scope that a reversal of the one-thought-per-second-is-enough tack will be automatic and inevitable.

The thematic framework, on which content, organization and architecture of the Science Exhibit are to be based, has been developed as a five-part demonstration of "the role of science in modern civilization." The concept is intended by the Exposition to reinforce the integrity of science as a force in history and contemporary life.

The Exposition framework is described:

In the introductory area (Area I) a multi-screen theater is being considered to introduce the messages of the exhibit and to enumerate problems to which science contributes solutions. In so doing, several concepts will be developed:

The nature, origin and growth of science; the values of science; the origin and impact of technology; and new problems and responsibilities in a changing world.

This section is intended also to delineate the propositions that knowledge is desirable for its own sake, that greater scientific activity will be required to solve problems of the future and the present, that support for scientific pursuits should be encouraged and that all citizens have responsibility for wise application of the findings of science.

The statement of plans continues:

"These basic concepts will be illustrated on several screens simultaneously to permit concurrent handling of this number of interrelated subjects in ten minutes. Film presentation will provide a controlled introduction before the audience moves into the main science exhibits.

"Area II, an area of 19,000 square feet will provide an introduction to science, its great men, great moments, unintentional discoveries, tools, method, breadth and scope.

"Area III may take the form of a 'spacearium,' or planetarium-once-removed, designed for audience orientation in space research and space perspectives, and for illustrations of time, distance and matter-energy relationships which require the cosmic scale. Here, again, the audience will have a ten-minute 'theatre' experience under a 75-foot dome, plus a close-up celestial education center.

"Area IV, the principal portion of the U. S. Science Exhibit, occupying space larger than a football field, will deal exclusively with scientific research. The American Institute of Biological Science and other scientific groups have been invited to help develop exhibitable concepts and ideas for areas where life sciences can be featured. Because of the breadth of research, timely items will be the most difficult to select and coordinate."

The opportunity to make an impact on 8,000,000 persons, with a dynamic exposition of the scientist's approach, and the results of his endeavor, is tempting.

How to present biology adequately and elegantly in a space-time continuum bounded by non-stop spectators is an even greater challenge.

Every effort will be made to avoid the natural tendency to emphasize technology, to confuse research with development and scientific end-results with gadgetry.

Hence, if science is to be faithfully depicted, it can logically be expected that the biological disciplines will do it, if for no other reason, perhaps, than that biology has less hardware to dramatize.

It can be observed, too, that the expected traffic rate is statistical only. Surely if biology is portrayed with sufficient quality and scope, the one-per-second average will be buried under an avalanche of delighted and stimulated spectators.

It remains only to provide the imagery, to capture in exhibits the zest of scholarly endeavor and the momentum and sweep of independent research, to unroll the panoramas of uncharted territories, to tune in the rhythms and harmonies of intellectual application, to unveil the mysteries and expose the satisfactions inherent in scientific literacy.

Biologists with ideas and, particularly, with specific, detailed and comprehensive proposals, should communicate them directly to Philip M. Evans, Federal Commissioner, U. S. Science Exhibit, U. S. Department of Commerce, Washington, 25, D. C., or to AIBS.

JOINT MEETINGS OF BIOLOGICAL SOCIETIES

SPONSORED BY

THE AMERICAN INSTITUTE OF BIOLOGICAL SCIENCES

Oklahoma State University

AUGUST 28—SEPTEMBER 1, 1960

STUDENT UNION BUILDING—AIBS HEADQUARTERS—STILLWATER

LOCAL ARRANGEMENTS COMMITTEE

Chairman: **Professor Fred LeCrone** ***Associate Chairman:*** **Dr. Robert MacVicar**

Organizations and Representatives

AMERICAN BRYOLOGICAL SOCIETY
Gilford J. Ikenberry, Dept. of Botany and Plant Pathology, Oklahoma State University

AMERICAN FERN SOCIETY
U. T. Waterfall, Dept. of Botany, Oklahoma State University

AMERICAN MICROSCOPICAL SOCIETY
Roy W. Jones, Head, Dept. of Zoology, Oklahoma State University

AMERICAN SOCIETY FOR HORTICULTURAL SCIENCE
David G. White, Dept. of Horticulture, Oklahoma State University

AMERICAN SOCIETY OF LIMNOLOGY AND OCEANOGRAPHY
Troy C. Dorris, Dept. of Zoology, Oklahoma State University

AMERICAN SOCIETY OF PLANT PHYSIOLOGISTS
Charles L. Leinweber, Dept. of Botany and Plant Pathology, Oklahoma State University

AMERICAN SOCIETY OF PLANT TAXONOMISTS
U. T. Waterfall, Dept. of Botany, Oklahoma State University

AMERICAN SOCIETY OF ZOOLOGISTS
Roy W. Jones, Head, Dept. of Zoology, Oklahoma State University

BIOMETRIC SOCIETY (ENAR)
Carl Marshall, Statistics Laboratory, Oklahoma State University

BOTANICAL SOCIETY OF AMERICA
W. W. Hansen, Dept. of Botany & Plant Pathology, Oklahoma State University

ECOLOGICAL SOCIETY OF AMERICA
Adolph Stebler, Oklahoma Cooperative Wildlife Research Unit, Oklahoma State University

GENETIC SOCIETY OF AMERICA
Herbert Bruneau, Dept. of Zoology, Oklahoma State University

MYCOLOGICAL SOCIETY OF AMERICA
John E. Thomas, Dept. of Botany & Plant Pathology, Oklahoma State University

NATIONAL ASSOCIATION OF BIOLOGY TEACHERS
Thomas Overmire, 1709 Admiral Road, Stillwater, Oklahoma

NATURE CONSERVANCY
Adolph Stebler, Oklahoma Cooperative Wildlife Research Unit, Oklahoma State University

PHI SIGMA SOCIETY
No local representative as yet appointed

PHYCOLOGICAL SOCIETY OF AMERICA
Imy Vincent Holt, Dept. of Botany, Oklahoma State University

SOCIETY FOR INDUSTRIAL MICROBIOLOGY
Ray C. Allred, Central Research Lab., Continental Oil Company, Ponca City, Oklahoma

and

Robert H. Huddleston (same address)

SOCIETY FOR THE STUDY OF DEVELOPMENT AND GROWTH
Roy W. Jones, Head, Dept. of Zoology, Oklahoma State University

SOCIETY OF PROTOZOOLOGISTS
Donald W. Twohy, Dept. of Zoology, Oklahoma State University

TOMATO GENETICS COOPERATIVE
David G. White, Dept. of Horticulture, Oklahoma State University

AIBS—SPONSORED MEETINGS OF BIOLOGICAL SOCIETIES

OKLAHOMA STATE UNIVERSITY

STILLWATER

August 28 - September 1, 1960

INFORMATION ON HOUSING AND MEALS

RESIDENCE HALL ACCOMMODATIONS—Rooms in well equipped campus residence halls may be reserved by persons attending the AIBS Conference. Accommodations are available for individuals, couples, and families. (Double rooms with single beds are available.)

It is necessary to assign two people to each double room. Therefore, two persons wishing to be assigned to the same room should make arrangements with each other before applying for University housing and indicate their preference in the space provided on the housing reservation form. If possible, the reservation forms should be mailed together. If requested in advance, an extra bed may be placed in a double room if parents desire to have their child in the room with them. Otherwise, adjacent rooms will be assigned to family groups as far as possible.

The room rate is $2.00 per night per person in a double room. Blankets, bed linen, soap, and towels are furnished. Limited maid service is provided. Occupants will have to make up their own beds. There are no private baths; however, student bathrooms are located on each floor. No charge is made for infants when parents supply their own crib and bedding.

PAYMENT FOR ACCOMMODATIONS IN THE RESIDENCE HALLS IS MADE AT THE TIME OF CHECK-IN.

Because of limited accommodations, everyone planning to attend the conference is urged to make housing reservations well in advance. Acknowledgment will be made for pre-registration forms received before August 14. These acknowledgments should be presented upon arrival at the registration area in the Student Union Building on the University campus. Your residence hall and room number will be designated at final registration.

Reservation requests for housing should be made on the application on page 35 and mailed to:

Fred LeCrone
107 Whitehurst Hall
Oklahoma State University
Stillwater, Oklahoma

DO NOT SEND MONEY WITH PRE-REGISTRATION. Acknowledgment of each advance registration received before August 14 will be made on a form which should be presented upon arrival at the registration area in the Student Union Building on the University campus.

OTHER HOUSING—Limited camping facilities are available 18 miles west of Stillwater at Lake Carl Blackwell on Highway 51. For further information and reservation requests, please write directly to Dr. Fred LeCrone, Whitehurst 107, Oklahoma State University, Stillwater, Oklahoma.

FOOD SERVICE—Food service will be available in three dining areas which will provide a la carte cafeteria service utilizing a pay-as-served system.

Persons in residence in Bennett Hall should plan to have their meals in the Bennett Hall cafeteria.

Persons in residence in Willard and Murray Halls should plan to have their meals in the Willard Hall cafeteria.

Persons in residence in Stout Hall, Cordell Hall and in off campus housing should plan to have their meals in the Student Union cafeteria.

Delegates should allow approximately $2.50 per person per day for cafeteria meals.

The cafeterias will be open for breakfast from 6:15 a.m.—10:15 a.m., for lunch 11:15 a.m.—1:30 p.m., and dinner 4:45 p.m.—6:30 p.m. The snack bars in the Student Union and in Bennett Hall will supplement the meal service by opening at 8:00 a.m. and closing at 12 midnight each day.

BANQUETS—Special breakfasts, luncheons, and banquets are listed in the schedule on page 34. Tickets may be purchased at final registration.

PRE-REGISTRATION

AIBS–SPONSORED MEETINGS OF BIOLOGICAL SOCIETIES

OKLAHOMA STATE UNIVERSITY

STILLWATER

August 28 - September 1

REGISTRATION AND HOUSING APPLICATION

Name..... (First) (Middle) (Surname)

Home Address..... (Street)

..... (City) (State)

Professional Address.....

.....

Title.....

Institution.....

Are you a Graduate Student?.....
(Graduate Students are eligible for a reduced registration fee)

Signature of major professor.....
(Applies only to Graduate Students)

Society Membership:
(1).....

(2).....

(3).....

I plan to attend the following society banquets.....

.....

I plan to take the following field trips.....

Please print or type the above information and mail to:

107 WHITEHURST HALL
OKLAHOMA STATE UNIVERSITY
STILLWATER, OKLAHOMA

Date.....

Male ☐ Female ☐

Roommate Preference..... (Name)

Couple ☐ Couple with children ☐

Child's name	Sex	Age
.....	.....	.....
.....	.....	.....
.....	.....	.....

Expected time of arrival at Stillwater, Oklahoma..... (Date, Hour)

Departure from Stillwater, Oklahoma..... (Date, Hour)

Please make reservations for me in a University Residence Hall ☐

I will not require housing ☐

Remarks:.....

.....

.....

TRAVEL ARRANGEMENTS

I expect to arrive by
train at Perry, Okla. (via Sante Fe R.R.) ..... (Date, Hour)

plane at Tulsa..... (Date, Hour)

plane at Oklahoma City..... (Date, Hour)

plane at Stillwater..... (Central Airlines) (Date, Hour)

bus at Stillwater..... (MK & O Lines) (Date, Hour)

automobile ..... (Date, Hour)

NOTE: Commercial bus service will be available from train station and limousine service will be available from airports to Stillwater.

Russian Biological Journal Translations

The AIBS is currently translating and publishing seven Russian research journals in biology. These journals are translated with support from the National Science Foundation, which is eager that such information be more widely distributed to biologists throughout the world. It is hoped that this material will aid biologists in research, prevent duplication of work, give some idea of what is being done by Soviet scientists in the field of biology, and also bring about a better international understanding among scientists. Four of these Journals are described below.

SOVIET SOIL SCIENCE • POCHVOVEDENIYE

This is a translation of the Russian journal, POCHVOVEDENIYE, beginning with the January, 1958 issue, and edited by Dr. A. P. Mazurak of the University of Nebraska. It publishes research done at various institutes in the fields of soil chemistry, soil physics, soil microbiology, soil fertility, soil genesis and classification, soil conservation, irrigation, and related aspects of soil science. The journal is divided into sections on general articles, methods, discussions, book reviews, and chronicles.

12 issues per year. First issues published: 1958. Current issues published: Jan.-Dec. 1958.

Yearly Subscriptions: $40.00, individuals and industrial libraries (U.S.A. & Canada); $20.00, AIBS members and all other libraries; $3.00, additional to each price, foreign. **Single copies:** $4.50.

ENTOMOLOGICAL REVIEW • ENTOMOLOGICHESKOE OBOZRENIE

Very few Entomologists would not find something of special interest to them in any one issue of this periodical. It deals with theoretical and practical problems in the field of entomology and their significance for the national economy. It contains articles on all branches of entomology and devotes particular attention to problems connected with the theoretical basis of agriculture and public health service.

4 issues per year. First issues published: 1958; Current issues published: 1958, Vol. 37, Nos. 1-4.

Yearly Subscriptions: $25.00, individuals and industrial libraries (U.S.A. & Canada); $12.00, AIBS members and all other libraries; $3.00, additional to each price, foreign. **Single copies:** $7.50.

PLANT PHYSIOLOGY • FIZIOLOGIYA RASTENY

This journal publishes original studies of an experimental nature on various problems of the physiology of plants, reviews, critical articles and discussions on major problems in this field.

The journal is divided into four sections and a few titles listed under each section from one issue are: General articles—The Interrelationships of Foliar and Root Mineral Nutrition in Plants, by N. I. Shereverya; and The Transport Form of Carbohydrates in Pumpkin Plants, by N. A. Pristupa; Brief Communications—Iron and Manganese in Photosynthesis, by E. A. Borchenko.

6 issues per year. First issues published: 1957, Vol. 4, Nos. 1-6. Current issues published: 1959, Vol 6, Nos. 1-6.

Yearly Subscriptions: $15.00, individuals and industrial libraries (U.S.A. & Canada); $11.00, AIBS members and all other libraries; $2.00, additional to each price, foreign. **Single copies:** $3.00.

MICROBIOLOGY • MICROBIOLOGIYA

This journal deals with problems of general microbiology (systematics, morphology, physiology and variability of microorganisms), agricultural microbiology (microbiology of soils and fodder crops, bacterial fertilizers), technical microbiology, the microbiology of foods and the microbiology of water reservoirs.

This journal also contains sections on the History of Science, Book Reviews, and Current Events in the field of Microbiology, as well as the general articles in this field.

6 issues per year. First issues published: 1957, Vol. 26, Nos. 1-6. Current issues published: 1959, Vol. 28, Nos. 1-6.

Yearly Subscriptions: $20.00, individuals and industrial libraries (U.S.A. & Canada), $15.00, AIBS members and all other libraries; $2.50, additional to each price, foreign. **Single copies:** $4.00.

All orders should be addressed to:

AMERICAN INSTITUTE OF BIOLOGICAL SCIENCES

2000 P St., N.W. Washington 6, D. C.

THE EDITOR'S DESK

Any member of societies affiliated with the AIBS who has served at any time as a **parasitologist in the U. S. Army** is requested to contact Lt. Col. Lyman P. Frick, MSC, 6th U.S. Army Medical Laboratory, Fort Baker, California. A history of the U. S. Army Medical Service Corps is now in preparation, and information on the duties, assignments, and accomplishments of all former Army parasitologists is urgently required.

To teachers of physiology—the Educational Committee of the American Physiological Society is compiling a series of new or unusual experiments illustrating important concepts for use in the teaching of elementary human physiology. Your contributions are requested. Please send them to Dr. C. Haywood, Department of Physiology, Mount Holyoke College, South Hadley, Massachusetts.

The United States Atomic Energy Commission has published a 29-page catalog, *Proceedings of Technical Meetings*, which is available without charge from the Commission's Technical Information Service Extension, P.O. Box E, Oak Ridge. Tennessee. The catalog lists and describes the published proceedings of 126 selected meetings, conferences, and symposia held during the past ten years in which the Commission or its contractors were sponsors.

The **Results of 1959 Fungicide and Nematode Tests** is now available. The report serves as a medium for organizing and presenting the summarized results of current fungicide and nematode testing projects. The cost is $1.00 per copy when accompanied by remittance or $1.25 when invoiced and billed. Send orders to A. B. Groves, Winchester Fruit Research Laboratory, Route 3, Winchester, Virginia. Remittances should be made payable to the American Phytopathological Society.

The International Society for Horticultural Science was officially formed at The Hague, The Netherlands, on March 26, 1960. Eighteen member countries were represented at the meeting. The Society will sponsor international gatherings on scientific horticulture, publish an information bulletin at irregular intervals, and publish the proceedings of the international meetings. The next international congress will be held in Brussels in September of 1962. Officers of the Society are: Dr. A. Lecrenier of Belgium, President; Dr. H. B. Tukey, Michigan State University, Vice-President; and Dr. G. deBakker, The Netherlands, Secretary-Treasurer.

The United States Committee of the International Union of the History and Philosophy of the Sciences is participating in a world-wide inventory of scientific instruments of historic importance. The committee is endeavoring to determine the locations of instruments which have been the basis of an important scientific discovery. Suggestions should be addressed to: Robert P. Multhauf, Head Curator, Department of Science and Technology, Smithsonian Institution, Washington 25, D.C.

The National Science Foundation has awarded the Los Angeles County Museum a grant of $7,400 for the work of **Dr. Theodore Downs,** Curator of Vertebrate Paleontology. The grant will extend for an additional year the research and field work conducted by Dr. Downs on fossil animals in the Anza-Borrego State Park in the Imperial Valley of the Colorado Desert.

The Scientific Advisory Committee of the Licensed Beverage Industries, Inc., 155 East 44th St., New York 17, N.Y., has announced a grant-in-aid program for researchers in the biological and behavioral sciences working on problems in the field of alcoholism. Information may be obtained from the Committee.

The Public Health Service has announced two grants totaling $1,917,275 to the Medical Research Foundation of Oregon, Inc., for the construction and operation of a Regional Subhuman Primate Research Center. The purpose of the Center is to provide a specialized environment for scientific exploration of all possible areas of study relating to the biological characteristics of rhesus monkeys over their entire life span.

Applications will be accepted through October 10, by the **National Science Foundation** for fellowships under the **Senior Postdoctoral and Science Faculty Fellowship** programs. Awards will be made in the mathematical, physical, medical, biological and engineering sciences. Application materials may be obtained from the Fellowships Section, Division of Scientific Personnel and Education, National Science Foundation, Washington 25, D.C.

Inquiries about obtaining **monkeys from the Philippines** for research purposes may be addressed to Filomeno S. Salutillo, 55 Saint Mary Street, Cubao, Quezon City, Philippines.

Concerted efforts to establish an **Anton J. Carlson Lectureship** have been announced by Dr. Dwight J. Ingle, Chairman of the Department of Physiology, The University of Chicago. An appeal is extended to individuals and groups in the fields of medicine, science and industry, to which Dr. Carlson made significant contributions.

Biological Meetings and Conferences

The American Heart Association's Annual Meeting and Scientific Sessions will be held in St. Louis, October 21-25. More information may be obtained from the Association at 44 East 23rd Street, New York 10, N.Y.

The Public Health Service announces a **Symposium on Water Quality Measurement and Instrumentation** August 29 through 31, in Cincinnati, Ohio. Anyone wishing to receive the agenda and other announcements may write to The Director Robert A. Taft Sanitary Engineering Center, 4676 Columbia Parkway, Cincinnati 26, Ohio.

The 7th International Soil Science Congress will be held at the University of Wisconsin, August 15 to 23. About 400 papers will be presented by the world's leading soil scientists. Further information may be obtained from Richard Bradfield, President, International Society of Soil Science, University of Wisconsin, Madison 6, Wisconsin.

A three-day **Symposium on Scientific Information** is being arranged as part of the program of the **Tenth Pacific Science Congress** to be held August 21 to September 6, 1961 at the University of Hawaii. Please address inquiries to: Secretary-General, Tenth Pacific Science Congress, Bishop Museum, Honolulu 17, Hawaii.

The XVIth International Congress of Zoology will be held in Washington, D.C., August 21-27, 1963, under the presidency of Dr. Alfred S. Romer, Alexander Agassiz Professor of Zoology and Director of the Museum of Comparative Zoology, Harvard University. The arrangements are being

made by a committee of the National Academy of Sciences—National Research Council, 2101 Constitution Ave., N.W., Washington 25, D.C., which should be contacted for further information.

The theme of the **Second Annual Western Resources Conference** will be "Water: Measuring and Meeting Future Requirements." The Conference will be held August 22-26 in Boulder, Colorado. Further information may be obtained from the Committee on Western Resources, Chemistry Building, Room 305, University of Colorado, Boulder.

The 13th Annual Conference on Electrical Techniques in Medicine and Biology will be held in Washington, D.C., October 31 through November 2. There will be a diversified program on biomedical electronics with emphasis on analytical techniques. The Institute of Radio Engineers, 1 East 79th St., New York City, can supply further information.

Opening sessions of the **Xth International Congress of the History of Science** will be held at Cornell University, and closing sessions will be held at the American Philosophical Society, Philadelphia, Pennsylvania. The entire Congress will take place from August 26 to September 2, 1962. Those wishing to receive bulletins concerning the meetings should write to the Secretary of the Congress of the History of Science, Cornell University, Ithaca, New York.

The **Annual Meeting of the Society of General Physiologists** will be held at the Marine Biological Laboratory, Woods Hole, Massachusetts, September 6 through 8. Dr. David M. Bonner of Yale University is organizing a symposium entitled "Control Mechanisms in Cellular Processes." Further information may be obtained from the Secretary of the Society, James W. Green, Rutgers, The State Unisity, New Brunswick, New Jersey.

The largest international gathering of foresters ever held will take place at the **Fifth World Forestry Congress** for two weeks, starting August 29, in Seattle, Washington. Two thousand experts from more than 50 nations are expected to attend. The Fifth World Forestry Congress Organizing Committee, Department of State, Washington 25, D.C. can supply further information.

The 10th Annual Instrument Symposium and Research Equipment Exhibit will be held in Bethesda, Maryland, October 4 through 7. Primary topics for discussion on the scientific program include; fluorescence, infrared, activiation analysis, ultra-centrifuge, microscopy, and electrodes. The Executive Secretary is James B. Davis, National Institutes of Health, Bethesda 14, Maryland.

The 18th Annual Meeting of the Electron Microscope Society of America will take place August 29-31 at Marquette University, Milwaukee, Wisconsin. Further information concerning the program of the meeting may be obtained from the Program Chairman, Professor W. C. Bigelow, Department of Chemical and Metallurgical Engineering, University of Michigan, Ann Arbor.

The Fall meeting of the **American Physiological Society** will take place at Stanford University, Stanford, California. For information, write the Executive Secretary, Dr. Ray G. Daggs, 9650 Wisconsin Ave., Washington, D.C.

A course on "Recent Developments in Water Bacteriology" will be presented August 15–19 by the **Training Program of the Robert A. Taft Sanitary Engineering Center.** The course is offered for professional bacteriologists and those in positions of responsibility in state, municipal, and other laboratories engaged in bacterial water analyses. Applications or requests for information should be addressed to the Chief, Training Program, Robert A. Taft Sanitary Engineering Center, 4676 Columbia Parkway, Cincinnati 26, Ohio.

The Biological Photographic Association will hold its 30th annual meeting in Salt Lake City, August 23–26. All persons interested in biological photography are invited to attend (membership not necessary). For further information write Howard E. Tribe, Division of Medical Illustration, University of Utah, Salt Lake City.

The 88th Annual Meeting of the American Public Health Association is scheduled for October 31-November 4 in San Francisco. Scientific sessions and exhibits will cover a wide variety of health programs and research development. At least 60 related health organizations are planning meetings in conjunction with the Association's sessions. For further information, address Dr. Berwyn F. Mattison, Executive Director, American Public Health Association, 1790 Broadway, New York 19, New York.

The Florida Entomological Society will hold its 43rd Annual Meeting in Jacksonville, at the Robert Meyer Hotel on September 8 and 9. Registration will begin on the evening of September 7. Further information may be obtained from the Secretary of the Society, L. A. Hetrick, P.O. Box 2425, University Station, Gainesville, Florida.

The Soil Conservation Society of America's 15th Annual Meeting will be held at Ontario Agricultural College August 28–31. Information should be requested from the Soil Conservation Convention, Department of Soils, Guelph, Ontario, Canada.

The Kaiser Foundation Research Institute will hold its Second Annual Symposium on Comparative Biology, entitled "The Lower Metazoa: Comparative Biology and Phylogeny," from September 6 to 10 at the Kaiser Center, Oakland, California. The meetings will be open to all interested persons. Information may be obtained from Dr. Ellsworth C. Dougherty, Kaiser Foundation Research Institute, South 14th and Cutting Boulevard, Richmond, California.

Notes on Biologists

Dr. Leon Jacobs, head of the Parasitic Disease Laboratory at the National Institutes of Health, Bethesda, Maryland, left May 1 for 8 months at the Wallaceville Animal Research Station, New Zealand, where he will work on ovine toxoplasmosis. He has received a Guggenheim award which will make it possible for him to visit laboratories throughout Asia. Dr. Jacobs is Chairman of the Committee on Cooperative Publication of the AIBS Conference of Biological Editors.

The Henry Baldwin Ward Medal was awarded to **C. P. Read,** Biology Department, Rice Institute, Houston, Texas.

Allan R. Robinson, who was on a National Science Foundation Fellowship at the Cavendish Laboratory of Cambridge University, will join the staff of Harvard University as Assistant Professor of Meteorology and Oceanography.

Dr. Kenneth M. Endicott, now an Associate Director of the National Institutes of Health, will be Director of the National Cancer Institute, succeeding **Dr. John R. Heller,** who has been granted leave of absence by the Public Health Service to accept the presidency of the Memorial Sloan-Kettering Cancer Center in New York City.

The appointment of **Dr. Malcolm C. McKenna** as Assistant Curator of Fossil Mammals and Birds at the American Museum of Natural History, New York City, has been announced.

The 1960 Howard Taylor Ricketts Memorial Award of the University of Chicago has been given to **Dr. Karl F. Meyer,** an authority on diseases of wild animals transmittable to man.

Richard W. Price, a graduate student at the University of Colorado, has been awarded a Fulbright grant for one year of study in histochemistry, electron microscopy, and bioelectric potentials of cell membranes at the University of Copenhagen and Carlsberg Laboratories in Denmark.

Dr. Lowell T. Coggeshell, who has been Dean of the Division of Biological Sciences at the University of Chicago, was recently appointed Vice-President of the University.

Beginning September 1, **Dr. Ernest W. Caspari** will become Professor of Biology and Chairman of the Department at the University of Rochester. Dr. Caspari will leave the position of Chairman of the Biology Department at Wesleyan University, Middletown, Connecticut.

Dr. John H. Litchfield, formerly Assistant Professor of Food Engineering at the Illinois Institute of Technology, has joined the staff of Battelle Memorial Institute where he will head research studies in food technology and fermentation within the Biosciences Division.

For the first time, Harvard's Prather Lectures in Biology will be given by a woman, **Katherine Esau,** Professor of Botany at the University of California, Davis. Professor Esau was president of the Botanical Society of America in 1951, and is one of the 50 botanists awarded Certificates of Merit by the Society.

The Department of State has announced that **Neal Weber,** zoologist at Swarthmore College, will go to Buenos Aires as Science Officer. Deputy Science Officer appointments include **John B. Bateman,** biophysicist with the United States Army Chemical Corps, to London; **William Littlewood,** oceanographer with the United States Navy Hydrographic Office, to Stockholm; **David C. Rife,** zoologist with the International Cooperation Administration, to New Delhi.

The University of Dayton has announced the promotion of **Dr. Daniel J. Higgins** to Assistant Professor of Biology. **Dr. George B. Noland and Bro. Robert J. Schuellein, S.M.,** have been promoted to Associate Professors of Biology.

Dr. George Streisinger has been appointed Associate Professor of Biology in the Institute of Molecular Biology at the University of Oregon, effective September 1. He comes from the Carnegie Institution of Washington, Department of Genetics. His principal present research interest is in the relationship between the structure of a protein, (bacteriophage lysozyme) and the structure of the gene which controls its formation.

Susquehanna University, Selinsgrove, Pennsylvania, has announced that **Robert S. Fulghum** of Blacksburg, Virginia will take over the teaching duties of **Howard E. Demott,** Associate Professor of Biology, while Dr. Demott is on sabbatical leave next year.

Dr. Albert B. Sabin was honored as the University of Cincinnati's first distinguished service professor at the Annual Alumni Association-Sponsored Banquet. Dr. Sabin's citation read "Eminent authority in research pediatrics, known with gratitude throughout the world as a benefactor of mankind for his achievements in alleviating the scourges of such virus diseases as poliomyelitis, Japanese B-encephalitis, and dengue fever."

The appointment of **Dr. Robert L. Zobel** as Medical Officer in Charge of the Indian Health Area Office at Albuquerque, New Mexico, has been announced by the Public Health Service. He succeeds **Dr. Charles R. Mallary,** recently named Deputy Chief of the Public Health Service's Bureau of Medical Services.

Dr. Nathaniel H. Cooper, formerly Director of Health of the Community Council of Greater New York, has been appointed Associate Medical Director and Director of Community Service and Education of the American Heart Association.

Professor Paul B. Sears, who has been Chairman of the Conservation Department at Yale University, will retire this June. He is a former president of the American Association for the Advancement of Science.

Edward S. Kirk, a member of the American Physiological Society, has received the William T. Porter Fellowship Award to study for two years with Dr. C. R. Honig at the University of Rochester, Rochester, New York.

The annual international Kalinga Prize for the popularization of science was awarded to French geneticist **Jean Rostand.** The prize is offered by the Kalinga Foundation of Orissa, India, and administered through UNESCO.

Dr. Nicholas T. Mirov, plant physiologist of the Pacific Southwest Forest and Range Experiment Station of the U. S. Forest Service, and Lecturer at the University of California is the recipient of a grant from the Rockefeller Foundation for continuation of his studies of pines.

Dr. James E. Canright, Associate Professor of Botany at Indiana University has been appointed a Guggenheim Fellow for the year 1960-61. He will be conducting a research program on primitive families of flowering plants in the Malaysian region. His major centers of operation during the course of this study will be the Botanic Gardens of Indonesia, Bogor, Java, and the Singapore Botanic Gardens.

Dr. Julius Sendroy, Jr., Chief Chemist and Head of the Division of Chemistry at the U.S. Naval Medical Research Institute, Bethesda, has been appointed a consultant to the U.S. Army Chemical Warfare Laboratories, Army Medical Center, Maryland.

An authority on the geology of New England, **James B. Thompson,** will become Professor of Mineralogy on July 1 at Harvard University, where he was formerly an Associate Professor.

Dr. Thomas G. Pridham, a microbiologist in the Fermentation Laboratory at the Northern Utilization Research Development Division, Peoria, Illinois, received the United States Department of Agriculture Superior Service Award and Silver Medal in ceremonies at Washington, D.C., May 17. The scientific investigations that led to this award were carried out as part of the utilization research program of the Agricultural Research Service, U.S.D.A. Dr. Pridham was recognized for his contributions to the identification and classification of microorganisms in the Actinomycete group.

Four important changes in the Office of the Director, National Institutes of Health have been announced by the Public Health Service. These changes will be effective July 1. **Dr. Joseph E. Smadel,** presently Associate Director for Intramural Research, will become Chief of the Laboratory of Virology and Rickettsiology in the Division of Biologics Standards. **Dr. G. Burroughs Mider** will replace Dr. Smadel in the new position of Director of Laboratories and Clinics. **Dr. Jack Masur,** Director of the Clinical Center, will become Associate Director for Clinical Care Administration. **Dr. Ernest M. Allen** will become Associate Director for Research Grants.

Dr. Sam Shushan, Associate Professor of Biology at the University of Colorado, has been elected President of the Colorado-Wyoming Academy of Sciences.

Information about the Biological Societies Meeting in Oklahoma

AIBS Meetings 1960—Many biological societies meeting with the AIBS at the Oklahoma State University are planning breakfasts. luncheons, teas, banquets. Those already scheduled appear below:

August 28

Dinner:
National Joint Committee on Fertilizer Application (Executive Committee) American Society for Horticultural Science (Executive Committee)

August 29

Luncheon:
Nature Conservancy
American Fern Society

Tea:
Wives of Horticulture Science members

August 30

Luncheon:
Genetics Society of America

Dinner:
American Society for Horticultural Science (Annual Banquet)
Society for Industrial Microbiology
American Society of Plant Taxonomists

Coffee:
Wives of Horticulture Science members

August 31

Buffet Luncheon:
American Society for Horticultural Science (Extension)

Transportation Information

Location: Oklahoma State University is located in Stillwater, Oklahoma. The general mailing address is Stillwater and the headquarters address for the AIBS meetings is 107 Whitehurst Hall, Stillwater, Oklahoma. Stillwater is situated in the north central part of the state about equal distance from both Oklahoma City and Tulsa. It is 282 miles north of Dallas, Texas and 135 miles southeast of Wichita, Kansas.

Highways: Stillwater and the University can be reached from the north on state highway 40 which connects with US highway 77 at Ponca City; and from the south on state highway 40 which terminates at its intersection with US highway 66 and the Oklahoma City-Tulsa toll road (turnpike); and from the west or east on state highway 51. If traveling from the east on US 66 pick up state highway 51 at Tulsa. If coming from the west on US 66 take US 77 north from Oklahoma City to the intersection of state highway 51 west of Stillwater.

Railroad: The Santa Fe stops at Perry, Oklahoma, 24 miles away, where bus or car tranportation will be available to Stillwater.

Airlines: Stillwater is served by Central Airlines. Connections may be made at Tulsa or Oklahoma City. Central will provide additional flights to Stillwater as the demand warrants and to the extent possible. Ordinarily, Central does not fly on Saturdays. Central Airlines leave Oklahoma City 2:40 P.M., arrive Stillwater 3:12 P.M. and leave Tulsa 5:05 P.M., arrive Stillwater 5:45 P.M. Limousine and rent-a-car service to Stillwater will be available at both Tulsa and Oklahoma City airports. Taxi service is available from the Stillwater airport to the University campus.

Bus Service: The MK&O lines operate buses into Stillwater from Oklahoma City, Tulsa, Ponca City and Shawnee connecting with cross country schedules in all directions.

Present bus schedules are:

Leave Tulsa	*Arrive Stillwater*
7:45 A.M.	10:10 A.M.
11:40 A.M.	2:10 P.M.
2:45 P.M.	5:05 P.M.
5:20 P.M.	8:05 P.M.

Leave Oklahoma City	*Arrive Stillwater*
8:20 A.M.	10:10 A.M.
12:15 P.M.	2:10 P.M.
3:10 P.M.	5:05 P.M.
6:15 P.M.	8:05 P.M.

Special Arrangements: Arrangements have been made with Central Airlines to run second sections of their flights on Sunday, August 28 and Wednesday, August 31 for the accommodation of enrollees at the conference. Please indicate with your preregistration your expected time of arrival in Tulsa or Oklahoma City.

Other Transportation: Avis air-taxi in Tulsa and Catlin air-taxi in Oklahoma City are available. These are small planes carrying three passengers. Fare from Tulsa is $30.80 and from Oklahoma City, $21.00.

Avis, Hertz and National Rent-a-car service is also available at both airports. Rates for each company are the same.

Field Trips:

August 28

American Society of Limnology and Oceanography and Ecological Society of America all day trip to Canton Lake, Waynoka Sand Dunes and Salt Plains Reservoir
Reservations—Dr. A. M. Stebler, Zoology Dept., Oklahoma State University.

ASLO afternoon trip to Cimarron River
Reservations after arrival—Troy Dorris, Zoology Dept., OSU

August 29

4:30 P.M.—Visit to Aquatic Biology Laboratory. Pollution abatement studies of oil refinery effluents
Dr. Troy Dorris, Zoology Dept., OSU

August 30

4:30 P.M.—Visit to Aquatic Biology Laboratory. Pollution abatement studies of oil refinery effluents
Dr. Troy Dorris, Zoology Dept., OSU

August 31

4:30 P.M.—Visit to Aquatic Biology Laboratory. Pollution abatement studies of oil refinery effluents
Dr. Troy Dorris, Zoology Dept., OSU

Thursday, September 1

ASLO all day trip to Conoco plant in Ponca City and Long Branch drainage system and Arkansas River. Will involve limnological and pollution studies.
Reservations—Dr. W. H. Irwin, Zoology Dept., OSU

Ecological Society and Nature Conservancy all day trip to Osage Prairie—Reservations: Dr. Ralph Kelting, Life Sciences Dept., Tulsa University, Tulsa 4, Oklahoma

Zoology one day trip to bat caves, Glass Mountains and Waynoka Sand Dunes. Reservations—Dr. Bryan Glass, Zoology Dept., OSU

Thursday, September 1 & Friday, September 2

Ecological Society two-day trip to Platt National Park, the Arbuckle Mountains and OU Biological Station on Lake Texoma. Spend night at Biological Station and return by way of Wichita Mountains and Wildlife Refuge. Reservations: Dr. Charles Carpenter, University of Oklahoma, Norman, Oklahoma

Family Activities: NOTE, Make arrangements for tours at family activities desk in registration area.

August 28

Gilcrease Art Exhibit, University Library. This exhibit will include a collection of 50 valuable and rare paintings of the Southern Plains area.

August 29

10:00 A.M.—Continental Breakfast, Student Union Ballroom—50¢

10:30 A.M.—Indians of Oklahoma—Lecture, Angie Debo

2:00–5:00 P.M.—Bridge and visiting, Student Union, Card Room, Modern Lounge

2:00, 3:00 and 4:00 P.M.—Walking tours of campus; leave from registration area, Student Union

7:30–9:30 P.M.—Square dancing; Garden Terrace, Student Union. Gilcrease Art Exhibit—Open all day, University Library

August 30

Family Tour—Air-conditioned Buses

No. 1. Ponca City—see oil refinery and Pioneer Woman Museum; children 12 and over should be interested. Cost $4.50 per person, plus meal

No. 2. Tulsa and vicinity—see famous art museum, garden center and other attractions. Cost $4.50 per person, plus meal. Children 12 and over may be interested.

No. 3. Pawnee—Children's Tour. $3.00 per person, including meal.

9:30–11:30 A.M.—Bridge and visiting, Student Union, Card Room, Modern Lounge

2:00–5:00 P.M.—Bridge and visiting.

Gilcrease Art Exhibit—Open all day, University Library

7:30–9:30 P.M.—Square Dancing; Garden Terrace, Student Union

August 31

9:30–11:30 A.M.—Bridge and visiting, Student Union, Card Room

9:00, 10:00 A.M.—Walking tours of campus; leave front registration area, Student Union

Gilcrease Art Exhibit—Open all day, University Library

9:00–11:30 P.M.—Indian Dances, University Stadium. Watermelons, courtesy Stillwater Chamber of Commerce

September 1

Gilcrease Art Exhibit—Open all day, University Library

9:30–11:30 A.M.—Bridge; Student Union, Card Room, Modern Lounge

Children's Activities:

Everyday, August 29, 30, 31 and till noon September 1

Supervised play, ages 6-12 and 12 and over—cost nominal

Group Nursery care — 3-5 age groups—cost nominal

Individual babysitters available for children at 50¢ per hour. Secure names at family activities desk in registration area.

The American Society for Horticultural Science *will not* sponsor a Field Trip during the AIBS annual meetings because in late August few horticultural crops, except ornamentals, are evident in Oklahoma. In lieu of a field trip, each Horticulture Department and USDA Horticultural Station will be sent a descriptive brochure describing places of interest and a companion road map of Oklahoma. Those members traveling by automobile will find it pleasant to combine a vacation with their participation in the meetings.

Societies Report New Officers

The Hercules Powder Company, an Associate of the AIBS, at its annual reorganization meeting, re-elected all officers of the Company as follows: Albert E. Forster, President and Chairman of the Board; Wyly M. Billing, John J. B. Fulenwider, John R. L. Johnson, Jr., Paul Mayfield, Edward B. Morrow, Vice Presidents; J. H. Tyler McConnell, Secretary; E. Charles Stump, Assistant Secretary; John E. Goodman, Treasurer; George B. Baylis, Arthur L. Perry, Alto J. Smith, and Paul J. Weber, Assistant Treasurers.

The American Physiological Society reports new officers for 1960-61: President, J. H. Comroe, Jr.; President-Elect, H. W. Davenport; Past President, R. F. Pitts; Executive Secretary-Treasurer, R. G. Daggs; Council, R. F. Pitts, J. H. Comroe, Jr., H. W. Davenport, H. S. Mayerson, J. M. Brookhart, T. C. Ruch, H. Rahn; Board of Publication Trustees, P. Bard, H. Rahn, H. S. Mayerson; Managing Editor, M. O. Lee.

Two new sections of the **Society for Industrial Microbiology** have been formed recently. **The Chicago Section** was organized in December, 1959. Officers elected are: President, A. David Baskin, Scientific Oil Compounding Co.; Vice President, Cyril Anderson, Armour Research Laboratories; Secretary-Treasurer, J. Harold Richardson, Armour and Company. **The Delaware Valley Section** was formed March 31, when Theone C. Cordon, a United States Department of Agriculture scientist, was named as President.

New officers of the **American Society of Parasitologists** are: President; Harold W. Brown, Columbia University. President-Elect; Justin M. Andrews, National Institute of Allergy and Infectious Disease. Vice-President; Paul E. Thompson, Parke, Davis and Company. Secretary; Francis J. Kruidenier, Zoology Department, University of Illinois.

The **American Bryological Society** reports the following officers for 1960, who will serve two-year terms: President; Roy F. Cain, Department of Botany, University of Toronto, Ontario, Canada. Vice-President; Mrs. Betty Higinbotham, Department of Botany, Washington State University, Pullman. Secretary-Treasurer; William A. Weber, University of Colorado Museum, Boulder.

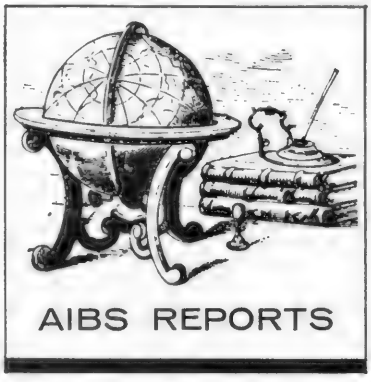
A list of current officers has been received from the **American Society of Human Genetics.** Serving as President until December; C. C. Li, University of Pittsburgh. President-Elect; L. C. Dunn, 501 W. 123rd St., New York City. Vice-President; Harold F. Falls, University Hospital, Ann Arbor, Michigan. Treasurer; H. Warner Kloepfer, Tulane University. Secretary; William J. Schull, University of Michigan, Ann Arbor.

Deaths Among Biologists

Dr. E. J. Kraus, Visiting Professor of Horticulture, Oregon State College, and former member of the Botany Department, University of Chicago. February 29.

Paul Bartsch, Professor Emeritus of Zoology at George Washington University, Washington, D.C. and former curator of mollusks at the Smithsonian Institution's National Museum. April 24.

J. Warren Lee, protozoologist and chairman of the Department of Biology at Southern University, Baton Rouge, Louisiana, April 1.



The American Association of Bioanalysts, an Affiliate Society of AIBS, is the fourth Society to take advantage of the Co-operative Publication plan offered by the AIBS, and sponsored by the Conference of Biological Editors. Mr. Lucien D. Hertert, Executive Secretary of the Association, has confirmed with Mr. Harwood, Director of

AIBS Publications, that the Business Management service will begin immediately.

Two new affiliate societies have joined the AIBS. They are the **American Electroencephalographic Society** and the **Federal Plant Quarantine Inspectors' National Association.**

Information about these societies may be requested from Dr. Garland L. Furr, President, Federal Plant Quarantine Inspectors' National Association, Room 128, Federal Inspection Station, P.O. Box 688, Nogales, Arizona, and Dr. George A. Ulett, Secretary, American Electroencephalographic Society, Department of Psychiatry and Neurology, Washington University School of Medicine, 1420 Grattan Street, St. Louis 4, Missouri.

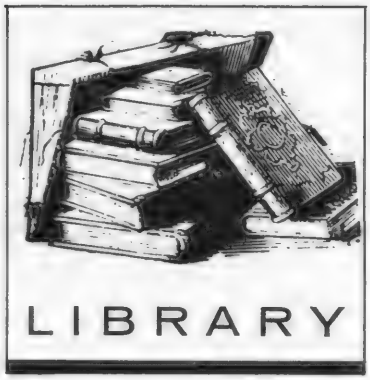
• Advisory editors have been named for three journals published by the AIBS and translated from the Russian by the Consultants Bureau. Dr. J. R. Porter will be Advisory Editor of *Microbiology*, Dr. Arthur W. Galston of *Plant Physiology*, and Dr. Charles C. Davis for the *Biological Sciences Section of Doklady*.

Educational Activities

The Educational Activities Department, under a contract with the U.S. Atomic Energy Commission, now handles arrangements for the AEC Directors Meetings of the Summer Institutes on Radiation Biology and for the AEC Education and Training Advisory Committee Meetings. A Summer Institute Directors Meeting was held March 30, 31, and April 1, 1960 at Duke University. A meeting of the Education and Training Advisory Committee was held in New Orleans May 2–4, 1960.

Currently, the Educational Activities Department is planning regional meetings for the speakers of the Visiting Biologists Program. The purpose of these meetings is to exchange ideas, to present and try to correct problems which may have arisen during the past year's program, and to give necessary and helpful information to participating speakers. The 1959–60 Visiting Biologist Program on the college and high school level proved to be highly successful and was received enthusiastically by both participating schools and visiting biologists. An excellent cross-section of schools, from rural to city school systems including Alaska and Hawaii, resulted. All but a few states were represented.

The AIBS Committee on Education met April 29–30, 1960. The next meeting will be held October 14, 1960 at Boulder, Colorado.



One copy of each publication submitted for listing should be sent to the Editor, AIBS BULLETIN, American Institute of Biological Sciences, 2000 P Street, N.W., Washington 6, D.C. Only books published within a year of receipt will be reviewed. Books marked with a ★ are those published by Bulletin advertisers.

Annual Review of Entomology. Volume 5. EDW. A. STEINHAUS and RAY F. SMITH, Editors. vii + 451 pp., illus. [20 articles, author index, subject index; cumulative title index and author index for volumes 1–5] Annual Reviews, Inc., Palo Alto, California. (1960) $7.00 USA, $7.50 Foreign.

H. M. Armitage has recently reviewed Volume 5 of this series for the *AIBS Bulletin* (February 1960). Much that he says is also applicable to the present volume. The value of review articles is often underestimated. They play an important role in the advance of research in nearly every biological field. The lack of reviews in certain areas of entomology has in the past been a definite handicap.

If nothing else, this volume illustrates the magnificent diversity of the work being conducted on insects. The 24 authors cover a multitude of subjects ranging from pure physiology to the application of insecticides. Each article has an extensive bibliography, unfortunately, cast in the style of chemical journals. The abbreviated references are thus of limited usefulness to those not already intimate with the particular field. The inclusion of titles, although possibly increasing cost, would more than repay in convenience to the users the extra expenditure.

The subjects covered are: flight muscles and their basic physiology (E. G. Boettiger); micromorphology (G. A. Edwards); neurosecretion (W. G. Van der Kloot); physiology of excretion (R. Craig); cytogenetics (S. G. Smith); chromosomal variation and adaptation (A. B. da Cunha); phylogeny of Coleoptera (R. A. Crowson); northern biting flies (B. Hocking); evolution and biology of termites (F. M. Weesner); biology of fruitflies (L. D. Christenson and R. H. Foote); host selection in phytophagous insects (A J. Thorsteinson); distribution and abundance (H. G. Andrewartha and L. C. Birch); sampling insect populations (R. F. Morris); use of honeybees in crop production (F. E. Todd and S. E. McGregor); biological background of locust control (D. L. Gunn); mechanisms of resistance to insecticides (A. W. A. Brown); application of insecticides (R. J. Courshee); citrus insects and mites (L. R. Jeppson and G. E. Carman); pesticides in relation to public health (W. J. Hayes, Jr.); and biological relationships of lice (Anoplura) and microbial agents (F. Weyer).

As one would expect, the articles are not all of equal literary merit, but all seem to represent careful and honest attempts to review and evaluate the recent progress in the subjects treated. As a teacher of entomology, and not a specialist in any of the subjects covered, I applied a rather specialized test. I tried to "look up" two points which have bothered me in my lectures: (1) Are the somatic as well as reproductive cells of the male honeybee haploid? (2) What exactly is the *rhabdome* of the compound eye? It was gratifying to find that (2) is satisfactorily answered on pp. 24-25 by G. A. Edwards and (1) on p. 78 by S. G. Smith. In the course of looking up these items, I found so much additional material that I am now revising my course. *Frank N. Young, Department of Zoology, Indiana University.*

Manual of Insect Morphology. E. MELVILLE DUPORTE. 224 pp., illus. Reinhold Publishing Co., New York, N. Y. (1959) $5.00.

Dr. DuPorte has instilled in this small book the essence of many years of experience in teaching. The writing is concise, but the technical terms are clearly defined. The student with a beginning course in entomology behind him should have a minimum of trouble following the directions for dissection and acquiring the more detailed knowledge of insect morphology necessary for advanced work.

Many of the exercises, however, are suitable for classes with a minimal background and could be used in elementary entomology courses or even with high school biology students. The teacher may find the lack of de-

tailed drawings a handicap, but the diagrams inserted in connection with particularly difficult subjects are clear and informative.

The format and printing are excellent, and the text seems relatively free of typographical errors. The binding allows the book to open and lie flat, a convenience sometimes overlooked in laboratory manuals. *Frank N. Young, Department of Zoology, Indiana University.*

The Control of Growth and Form: A Study of the Epidermal Cell of an Insect. V. B. WIGGLESWORTH. iv + 140 pp. illus. Cornell University Press, Ithaca, N.Y. (1959) $3.00.

This book is based upon the Messenger Lectures delivered by Dr. Wigglesworth at Cornell University in October, 1958. The six chapters are a distillation of the research carried on by this remarkably prolific man over the past thirty years. To accomplish this in 123 pages with freshness and simplicity is no mean achievement for one with Dr. Wigglesworth's bibliography.

The story begins with the epidermal cell of *Rhodnius prolixus*, a blood-sucking bug, and its routine function of laying down new cuticle during the recurrent cycle of growth and moulting. As the insect grows the cuticle increases in area, and new sensory hairs, dermal glands, and oenocytes must be interspersed among those already present. The absorbing account of the differentiation of epidermal cells into these structures exemplifies Dr. Wigglesworth's genius for seeing the significance in what to most people is insignificant. All the drama of growth and differentiation is revealed in the epidermis of *Rhodnius*, and the reader is brought to the edge of what is known about these general processes.

These are local events. The following chapters connect them to the general humoral control of growth and form in *Rhodnius*, and outline the discovery and action of the moulting and juvenile hormones which has been such an exciting chapter in insect physiology. Attention remains focused on the activities of the epidermal cell, and the reader is made to see in proper perspective the relation between gross changes in size and form and intimate events in the cuticle.

The action of these hormones in proper sequence determines what may be called the serial polymorphism of insects—the sequence of egg, larva, pupa, and adult. Dr. Wigglesworth discusses abnormalities and intergrades of these serial forms in relation to hormonal disturbances, always keeping the epidermal cell in center as the target for these actions and the ultimate source of gross external morphology. Sexual dimorphism, the polymorphism of ant and termite castes, and of mimicry in butterflies and many other insects may also be referable to the potentiality of their epidermal cells to take alternate developmental pathways. A side branch from the pathway developed by Dr. Wigglesworth in his research may well lead to a fuller understanding of polymorphism in animals.

The book closes with a discussion of the integrative factors in growth. A local break in the epidermal sheet, as by a small wound, may have widespread effects on the general hormonal mechanism controlling growth and differentiation. It appears to be essential that epidermal cells maintain physical contact with their neighbors however thinly they may be spread. Dr. Wigglesworth suggests that this contact may be the pathway of a neglected integrating system that is much older than the well-known nervous and humoral mechanisms. He envisions a continuous and direct chemical interchange between body cells, and likens it to the "food-sharing" that integrates the members of a honeybee colony.

If this simply told story is read carefully, as it should be by all students of growth and other forms of integration in animals, it will become clear why insect physiologists regard Dr. Wigglesworth as their most distinguished colleague. *K. D. Roeder, Department of Biology, Tufts University.*

The Molecular Basis of Evolution. CHRISTIAN B. ANFINSEN. xiii + 228 pp., illus. John Wiley and Sons, Inc., New York, N.Y. (1959) $7.00.

Since general agreement on the role of DNA in information transfer has been reached, one of the most challenging problems in biology is the determination of the mechanisms by which this information is translated into the definitive organism. Further, just how can such a system continue to properly function while undergoing evolutionary change? Dr. Anfinsen shows how the techniques of biochemistry, especially protein chemistry, will be indispensable in the resolution of such problems.

Beginning with an elementary discussion of evolution and classical genetics Dr. Anfinsen proceeds to the interrelationships of genetic fine structure and protein synthesis. The concluding chapter is devoted to protein homology as an expression of phylogenetic relationships.

The numerous illustrations facilitate understanding of the sometimes complex ideas presented. The few, minor mistakes detected occur mostly in the areas of biology with which the author is admittedly less familiar.

Taken in its entirety this little volume should serve to stimulate investigation and, perhaps more importantly, synthesis of ideas from the diverse fields that will contribute to a more complete understanding of the mechanisms of genetics and evolution. *D. Pettus, Department of Zoology, Colorado State University.*

★Principles of Paleobotany. WILLIAM C. DARRAH. 2nd ed. The Ronald Press Co., New York. (1960) $6.50.

Since it was first announced by Frans Verdoorn more than five years ago, I have waited with considerable anticipation for the revised edition of Darrah's *Principles of Paleobotany*. The first edition of this book appeared in 1939 as Volume III of "A New Series of Plant Science Books" edited by Frans Verdoorn. Later, in the same year, a somewhat longer version of this book covering similar subject material was manufactured by another publisher under the title, *Textbook of Paleobotany*. The latter had the advantage of more illustrations and better organization of the chapters. Both books were found to be deficient with respect to the proper crediting of materials originating from other sources, and as might be expected, their value was lost, for the most part, in the discussions of ethics that followed. In spite of this and some other difficulties the 1939 publications were broad in scope and represented the first comprehensive paleobotany texts written by Americans. In addition to the usual phylogenetic presentation of the paleobotanical record, the floristics of various geological ages were considered in separate chapters. Also, such topics as origin of present floras, the paleobotany of coal and techniques for the preparation of plant fossils for study were included. This book has proved useful to students of botany and historical geology as well.

In its coverage the 2nd edition of *Principles of Paleobotany* is very much the same as the first except for some increase in the illustrative material. There are 22 full-page pictures depicting landscapes with reconstructed floras. Some of these are "Standards," i. e., reconstruction of the Middle Devonian forest of Gilboa (New York State Museum) and the famous Pennsylvania forest as displayed at the Chicago Natural History Museum. Others are less well known but are nonetheless informative in showing the general aspects of the floras for various major divi-

sions of geological time. Some illustrations (Fig. 46, *Metasequoia*) are of greater historical interest than of scientific value. Although illustrations have been added more are required in a book describing paleobotanical materials because the specimens are usually rare and can not be seen by students and instructors of paleobotany courses.

The bulk of the materials discussed in the 2nd edition is a repetition of the classical works which have appeared in paleobotany and morphology texts for the past 30 years. The continued use of this kind of material is justified by the author in the preface to the 2nd edition where he states, "Emphasis, however, is placed upon classic work, even when recent monographs are available, to retain a historical point of view and to convey a sense of the cumulative nature of scientific knowledge as well as the continuity of life." In some places the inclusion of material of historical interest is mandatory simply because nothing has been added to our knowledge in that particular area. However, in many groups, i.e., the Pteridosperms, Cordaitales, Coenopteridales, Sphenopsida, Lepidodendrales, etc., with which Mr. Darrah is familiar, the information accumulated during the past 20 years from American materials exceeds the information provided by the "classical work" of the earlier British and European authors. It was my hope that the author, in preparing the revision, would avail himself of the American material and write the first paleobotany text in which the emphasis was changed from the oft-repeated "classical work." It appears that students and instructors of paleobotany in America must continue to wait for such a text.

Some attempt has been made to revise those chapters of the earlier books which drew considerable criticism because of their similarity to the original source material. One might hope that these parts would be completely rewritten, but this is not the case. The chapter on nonvascular plants will be of little value to the student because of the lack of illustrations and description of the fossils. This chapter might better have been deleted especially when one observes that Nematophytales appear under the subheading "Fossil Fungi." The author apparently knows that the nematophytes are usually considered members of the Phaeophyceae as indicated by their inclusion in this group on page 271. At the same time on this page he also includes *Protosalvinia* under the subheading Nematophytes. I doubt if an elementary student of paleobotany would be able to avoid some mistaken conclusions about relationships of fossil plants without the help of the instructor.

Some statements which are open to question appear in both old and new editions. One which has been criticized by instructors and students appears in the first sentence of chapter 8 (2nd Ed.) where it is said that Sphenopsida and Lycopsida are without branch gaps. Also, in the new edition the author has indicated the existence of vascular plants in the Cambrian of Russia. He, like many other authors, failed to go back to the original Russian article by Kryshtofovich who says that the fossils described are similar in appearance to vascular plants but at the same time he is careful to point out that there are no cellular remains, thus no vascular tissue was observed. Because of these and other inaccuracies and generalities which are not consistent with modern paleobotanical interpretations, I have obtained the impression after reading the 2nd edition and comparing it with the first that the author spent little time and effort in modernizing or correcting his revision.

The format of the book is excellent; it is well constructed and easy to read because of the good-sized type on quality paper. In this respect the 2nd edition is greatly improved over the first. *Wilson N. Stewart, Department of Botany, University of Illinois.*

The Families of Flowering Plants. Vol. I, Dicotyledons. Vol. II, Monocotyledons. J. HUTCHINSON. 2nd ed., 792 pp., illus. Oxford University Press, London. (1959) $23.55.

The appearance of a new edition of Hutchinson's work will be welcomed by plant taxonomists and botanists in general. Actually only Volume II represents a revision, for the treatment of the monocots is the same as in the 1934 edition with the addition of a single new family, the Cartonemataceae, and the listing of a few new genera. Although it is unfortunate that he was not able to include a revision of the tribes of the Gramineae by Hubbard, his treatment of the phylogeny of the families of monocots still remains the best available in spite of the lapse of 25 years since it was first published.

In his treatment of the dicots in 1926, Hutchinson proposed a somewhat radical arrangement by recognizing two main phylogenetic lines, one composed primarily of arborescent types and a second in which the herbaceous habit was predominant. In spite of the considerable criticism which met this scheme, in the new edition he has again recognized the two main groups, the Lignosae and the Herbaceae. The resemblances between such families as the Araliaceae and the Umbelliferae, the Verbenaceae and the Labiatae, for example, he considers the result of parallel evolution rather than an indicator of close relationship. Within his two main groups he has made considerable changes from his original system, the chief one being the redistribution of the sympetalous families.

Whether or not his phylogenetic scheme is widely accepted does not impair the usefulness of his book. The accounts of the various systems of classification, the keys to all the orders and families, the brief but adequate descriptions of families and orders, the keys to genera in the smaller families, and the numerous illustrations and maps, make this a most excellent reference work. *Charles B. Heiser, Jr., Department of Botany, Indiana University.*

Wildlife of Mexico: the Game Birds and Mammals. A. STARKER LEOPOLD. xiii + 568 pp., illus. by Charles W. Schwartz, foreword by Enrique Beltrán. University of California Press, Berkeley and Los Angeles. (1959) $12.50.

The author, Professor of Zoology and Associate Director of the Museum of Vertebrate Zoology at the University of California, Berkeley, spent more than twelve years in the preparation of this book, including extensive periods of field investigation in all parts of Mexico. Dr. Leopold, in preparing this volume, had in mind as his "most important audience the people of Mexico who are interested —or might become so—in natural history, hunting, or conservation." The author has been eminently successful in bringing together in easily readable style what is known today of the native game animals of Mexico. A Spanish translation of the book is planned for immediate publication. Such a volume will do much to enhance the public understanding of the wildlife conservation problems in a country where the hunting of wild game always has been an important activity and where the wildlife, if properly managed, can be maintained as a valuable resource for the future. Evidence that the English version warranted publication was the author's receipt of the Wildlife Society's award for the best terrestrial wildlife publication of the year. It will be read with much pleasure and provide authoritative information to conservationists and sportsmen, and to wildlife biologists, students, teachers, and administrators in many parts of the world.

The book consists of three main parts plus a sincere and appreciative foreword by Enrique Beltrán, Director of the Instituto Mexicano de Recursos Naturales Renovables; a table of contents; introduction by the author; Appendix A, Mexican Game Law; Appendix B, Hunting Regulations; a bibliography of 200 publications cited in the text and representing approximately one-third of the publications utilized in writing this volume; and a 10-page index prepared in sufficient detail to greatly facilitate the use of the book as a reference.

Part I, "The Wildlife Resource and Its Management," 93 pages, gives a general account of the topography, climate, and vegetation of the country; outlines important land use-wildlife relationships; analyzes the current governmental program of wildlife conservation in Mexico; and suggests possible ways in which this might be strengthened. The need for additional financing and the integrating of wildlife management into a broad conservation program involving better use of soil, water, grass, forest and other resources is stressed, as are the needs for extension and education, research, and technical training. Establishment of systems of national parks and national wildlife refuges are needed to provide protection to endangered species, such as the Imperial ivory-billed woodpecker (*Campephilus imperialis*), and to preserve examples of original biotic types, such as in the cloud forest, the desert mountains, and the interior grasslands. Better enforcement of the Mexican game laws is pointed out as a pressing need, wildlife now being subjected to sport hunting, hunting for food, and certain types of commercialization.

Part II, "The Game Birds," 210 pages, and Part III, "The Game and Fur-Bearing Mammals," 207 pages, present accounts of individual species of game birds and mammals respectively. The 1954 version of the Mexican game law enumerating the families and many of the individual species considered to be game was used as a guide in formulating the list of species treated; otherwise if "game" had been interpreted as animals taken for sport, for food, or for usable products such as fur, practically all the birds and mammals in the Mexican fauna would have been included. According to the author, nearly all are used for something—cormorants, anhingas, parrots, herons, orioles, towhees, and pocket gophers, for example, being taken for food, and hummingbirds for their supposed medicinal properties.

Under the individual accounts are the generally accepted English name, the scientific name, and other names; the description, giving criteria for identification, approximate weights and measurements; a plate of drawings by the well-known wildlife artist, Charles W. Schwartz, and photographs when available; a range map on which actual records of occurrence are plotted; an account of the natural history of the animal; and a report on present status of the species and problems of its management.

These accounts contain a wealth of information on the various species treated. Of particular interest to the reviewer were the accounts of such rain-forest species as the tinamous, the howler monkey, and the white-lipped peccary; the tapir (*Tapirella dowii*), a species exterminated in much of its former range and now living only in the wildest and least disturbed wet tropical forests of southeastern Mexico; and the kinkajou (*Potos flavus*) and other little-known species.

Waterfowl hunters of the United States and Canada will be reassured to note that in the author's opinion the aggregate kill of waterfowl in Mexico is low. At the same time the author decries the loss of valuable waterfowl wintering areas in interior Mexico due to use of water for irrigation and to the drainage of lakes for agriculture. Although sandhill cranes (*Grus canadensis*) are listed as game birds, and are subject to hunting from November 1 to January 3, with a bag limit of five birds per day, few birds are killed due to their wariness. Those wildlife managers who are inclined to consider shooting of little importance on the year to year welfare of wildlife species will be interested to know, however, that in Dr. Leopold's considered opinion several species are over-hunted in Mexico. Thus, in writing of the great curassow (*Crax rubra*), the author states, "At various camps I found curassows scarce or even locally extinct in good habitat as a direct result of shooting;" and later, in commenting on the wild turkey, "Turkeys are so large and their flesh is so esteemed that they are more or less severely over-hunted wherever they occur in Mexico. Only in remote country, or on some private ranches where hunting is prevented by the owner, are turkeys still abundant."

Among the big game species the author points out that, "Although the carrying capacity for antelope on the the northern plains and deserts has obviously been lowered by overgrazing, this is not the main factor in reducing the species to its present precarious state, but rather overhunting." In this same section of the book, he further states, "The critical plight of the bighorn, like that of the antelope, is more the result of overhunting than it is of range difficulties. Although hunting is nominally prohibited, it goes on constantly."

This book is recommended highly to conservationists, sportsmen, naturalists, and wildlife managers. *Daniel L. Leedy, Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, U. S. Department of the Interior.*

★Introduction to Plant Physiology. B. S. MEYER, D. B. ANDERSON, and R. H. BÖHNING. 541 pp.; illus. D. van Nostrand Company. (1960) $7.50.

Since the publication of the first edition of Meyer and Anderson's *Plant Physiology* in 1939, this text and its companion laboratory manuals have dominated the scene as far as introductory courses in Plant Physiology are concerned. A dominant textbook may reflect a dominant point of view: it often indicates that the teacher who adopts the book either shares the point of view or is, at least, content with it. Concomitantly, it reflects the point of view with which the student will become inculcated, at least in many cases. For these reasons it is noteworthy that the widely-used Meyer and Anderson text has now appeared in a new, shorter version. An examination of *Introduction to Plant Physiology*, by Meyer, Anderson, and Böhning (Van Nostrand, New York, 1960) may shed some light on the present status of Plant Physiology, and its teaching, in the United States.

In their preface the authors explain that this new text has been brought out in response to repeated requests for a shorter version of the book—one particularly adapted for use in one semester or one quarter courses in Plant Physiology. They state that the new text resembles the parent volume in general outline, philosophical and pedagogical approach, and in contents, but that nevertheless it is not merely a "cut-and-paste" condensation. Rather, they claim, many sections have been rewritten, and additional material has been introduced at numerous points in the text in order to cover important recent advances in the field. Compactness, it is claimed, has been achieved "principally by reducing coverage of certain topics which seem less central to development of the main concepts of plant physiology, by reducing the number of illustrative examples, and by eliminating all discussion of techniques of measuring processes.

Examination of the new text indicates that the authors have indeed ful-

filled these claims. In contrast with the second (1952) edition of the longer work, the new text contains ten fewer chapters and 243 less pages. Among the specific changes which have been effected, we find, in the new text, elimination of the separate author index, a greatly reduced treatment of water relations and related phenomena, elimination of the separate chapter on plant movements, and incorporation of much new material reflecting recent advances in knowledge of factors influencing photoperiodic induction, seed germination, action of plant hormones, et cetera.

Like the editions which preceeded it, this book is outstanding in its clear and thorough presentation of many fundamental aspects of plant physiology and of the chemical and physical phenomena which underlie them. On the other hand, there can be no question of the authors' claim that the new text resembles the parent volume in general outline, philosophical and pedagogical approach, and in content. Here, in this reviewer's mind, lies the difficulty.

When it first appeared in 1939, Meyer and Anderson's text reflected the preoccupation of plant physiologists generally, and of the Ohio State group in particular, with water relations, the colloidal state, mineral nutrition, and translocation. The second edition of the parent text, while incorporating recent findings in metabolism and growth phenomena, retained this initial preoccupation and thereby, in my opinion, failed to accurately represent the then current status of the discipline. The present text does the same.

The fact that the volume contains an abundance of new material does little to alter the basic objection that it represents an outmoded point of view. For example: although it reports an up-to-date score on the essential mineral elements, there is only brief and general discussion of the possible roles of the elements; although there is an outline presented of the major catabolic pathways, there is no mention of any of the alternate pathways (HMP shunt, dicarboxylic acid cycle, etc.) which have occupied the attention of so many researchers recently; although there is a discussion of the work of Calvin's group on the path of carbon in photosynthesis, there is no mention of photosynthetic phosphorylation and only a one sentence reference to the important experiments of Ruben, Randall, Kamen, and Hyde on the source of the oxygen evolved during photosynthesis; no mention is made of pathways of fat breakdown; the diagram of the Krebs cycle (p. 286) contains three spelling errors, one incorrect reaction, and omits an important intermediate; and throughout the book one notes that the data on which figures and tables are based have been derived primarily from publications thirty and more years old, almost invariably in instances where more accurate, modern data are readily available.

These faults, and similar ones, could, of course, be corrected within the present context. One might argue that rectification of the omissions cited above would obliterate the reduction in length which the present book was designed to achieve. This is not the case, however, if one takes note of certain of the topics which have been retained in the text and whose essentiality in a short book of plant physiology is questionable, the excellence of the material notwithstanding. Is it necessary, for example, to devote entire chapters, or large portions of chapters to purely descriptive (i.e., non-physiological) discussions of cell structure, vegetative growth, reproductive growth, and the anatomy of the transport tissues? Does not such material belong more properly to prerequisite courses or supplementary readings?

But even if these changes were made, the fault, I think, still lies in the basic context, the "point of view." This is best illustrated by the treatment afforded to the effects of red and far red light. The roles of these radiations are mentioned at the appropriate places in chapters 20 (environmental factors influencing vegetative growth), 22 (environmental chapters influencing reproductive growth), 23 (growth correlations and periodicity), and 24 (germination and dormancy). At no point, however, is mention made of the important fact that the action spectra for initiation and reversal of seed germination, flower induction, and hypocotyl straightening are the same, and that therefore the biochemical events underlying these phenomena are most likely the same or closely similar. This fact can best be treated and emphasized adequately in an outline that considers photodynamic effects *per se*, which is the way in which modern researchers in plant physiology do indeed treat them.

Plant physiology has made exciting and significant strides in the last 25 years. These strides, in many instances, represent new trails broken and new vistas opened. They are not all mere appendages to classical knowledge or new extensions to classical points of view. Courses in botany, and particularly first courses in plant physiology, are the recruiting ground from which new investigators will be enlisted, either directly, as they are attracted into research in the field, or indirectly, as they in turn influence *their* future students. It is thus of utmost importance that textbooks in the field accurately represent the present state of knowledge and probable future trends in research interest. *Introduction to Plant Physiology* is inadequate in this regard. *Walter G. Rosen, Department of Biology, Marquette University.*

Anatomy of Seed Plants. KATHERINE ESAU. 376 pp. John Wiley and Sons, Inc., New York. (1960) $6.95.

Students and teachers involved in courses in plant anatomy will gladly welcome Professor Esau's *Anatomy of Seed Plants*. While her classical and exceptional text on *Plant Anatomy* serves as a reliable and authoritative source of information on plant anatomy, users of that book in courses have found it a little cumbersome. The new text is admirably suited to the first course in plant anatomy. It is not merely a condensation of the larger book, but represents a rewriting and reorganization with a different end in mind. Even most of the illustrations are new.

Professor Esau's approach is largely ontogenetic. In fact, the chapter immediately following the introductory one is concerned with the embryo. The third chapter presents sequences of events from the embryo to the adult plant. Different from her *Plant Anatomy* is the discussion of apical meristems in the chapters on roots and stems, rather than in an independent chapter. This reviewer agrees with this fortunate choice, because apical meristems take on more significant meaning to beginning students when discussed in the light of mature structures produced from them.

Other improvements making the book more suited for class use are the inclusion of a key to some common woods, and the placing of all photographic illustrative material within the text, rather than in a section at the end of the book.

One is inclined to regret that there could not have been a little more emphasis on phylogenetic implications, but the ontogenetic approach is certainly a justifiable one, and one for which the author is particularly suited. A distinct service to botany at a time when many biologists seem to be losing sight of the entire organism are Professor Esau's comments in the preface concerning the still important role of plant anatomy, even in modern aspects of the botanical sciences. *Theodore Delevoryas, Department of Botany, Yale University, New Haven, Connecticut.*

The Extremities. DANIEL P. QUIRING, and JOHN H. WARFEL. 120 pp.; 105 figs. Lea & Febiger, Philadelphia. (1960) $3.50.

This is the second edition of Quiring's book, the first having appeared in 1945. Doctor Warfel, in preparing the second edition, has made no attempt to alter greatly the general form of the book as originally conceived by Doctor Quiring and his associates.

Revisions made in this edition have been chiefly in reference to the 27th (100 Anniversary) Edition of *Gray's Anatomy* (Philadelphia, Lea & Febiger, 1959). The names of some of the muscles have been altered in order to conform to the 1955 Paris Nomina Anatomica. Fourteen plates have been redrawn to correct for small anatomical errors in the originals, and the order of presentation of muscles has been altered slightly to follow the sequence in Gray.

The book itself is a model of clear presentation of anatomical structure and relations. Those accustomed to the beautiful and elaborate pictures of our detailed atlases may be somewhat disappointed in the schematic line drawings of the figures. It cannot be denied, however, that this method of presentation makes it possible for the student to see almost immediately the location, origin, and insertion of a muscle, or the course of a nerve or blood vessel. Such important facts often are difficult to see without considerable time and effort in some of the elaborate figures in our larger texts and atlases.

An interesting feature of the book is the presentation of the motor point for each muscle, the region where stimulation at the surface bring about the greatest contraction of that muscle. A knowledge of these motor points is, of course, essential in clinical testing of the state of health or disease of nerves and muscles, but in addition it is very useful to those who wish to stress *functional* anatomy. The authors are careful to state that there will be a certain amount of individual variation in the location of these points.

The Extremities is a book which will prove highly useful and stimulating both to students and teachers of anatomy. *Warren Andrew, Chairman, Department of Anatomy, Indiana University School of Medicine, Indianapolis.*

Diagnosis of Veterinary Parasitisms. J. H. WHITLOCK. 236 pp. Lea and Febiger, Philadelphia. (1960) $10.00.

This handbook is intended for the use of veterinarian practitioners and students. As an aid in the identification of common parasites of domestic animals. It is intermediate between a text and a laboratory manual. The book is divided into two main sections, Veterinary Entomology, which the author defines as "the parasitological relationships that exist between the domestic animals and members of the Phylum Arthropoda" and Veterinary Helminthology. Many readers will object to the inclusion of crustaceans, archnids, pentastomids, and hexapods in entomology.

The class Pentastomida is treated in the chapter on the order Acarina. This is misleading and likely will cause confusion to a beginning student. The same situation exists when the phylum Acanthocephala is treated in the chapter entitled "The Suborders Dioctophymata and Trichurata."

Both line drawings and photomicrographs are used to illustrate the text. The line drawings are clear and well executed while the photomicrographs are better than average. Labels would enhance their value for the student.

Marginal references to the appropriate illustration are made both in the text and keys. This should prove valuable to the user. The appendix includes a short discussion on diagnostic problems at the boundary area between veterinary and medical parasitology as well as a few notes on the preparation of slides.

The author has succeeded in providing the practicing veterinarian with a useful reference for the rapid identification of parasites he is likely to encounter in his work. *Charles B. Curtin, University Station, Charlottesville, Virginia.*

Make Your Technical Writing Useful. WERNER O. NAGEL. 31 pp. American Fisheries Society and The Wildlife Society. (1960) $1.00. Available: Secretary, American Fisheries Society, P.O. Box 483, McLean, Virginia.

This technical writing manual is written "in the form of suggestions to all wildlifers for improving the quality and usability of wildlife literature." According to Mr. Nagle poor technical writing is a prevalent and serious problem handicapping the advancement of wildlife management.

Wildlife research cannot end with the finding of new facts if management practices are to be improved; these facts must be made available to administrators, wildlife managers, and others who need them in their work. Usefulness of the results is the main justification for wildlife investigations.

When careless writing habits are permitted, distorted facts often occur despite the accuracy with which the research has been carried out. The author cites misrepresentation of facts as probably the gravest defect in technical, wildlife literature.

The succinct, practical procedures for planning and writing scientific articles suggested in *Make Your Technical Writing Useful* will serve as a profitable guide for the researcher as he organizes, writes, and self-edits his prospective paper. The author reminds the technical writer that a well-written paper will be rewarding, not only to co-workers by providing them more useful information, but to the writer in getting his articles published. *Gilbert R. Magee, American Institute of Biological Sciences.*

Medical Museum Technology. J. J. and M. J. EDWARDS. ix + 172 pp. Oxford University Press. (1959) $3.40.

A third of this book concerns the history of medical museums; the great progressive step in these institutions was the development of preservation by formalin in the late 1880's. Today the development of embedding in plastics offers new vistas for the preparation of medical material as it does for zoological specimens, and much of the information in this book will be of interest to preparators in general museums and supply houses as well as others concerned in one way or another with preservation and exhibition of zoological material. *J. W. Hedgpeth, Pacific Marine Station, College of the Pacific.*

A History of Biology to about the Year 1900. CHARLES SINGER. Third and revised edition. 580 pp. Abelard-Schuman, London and New York. (1959) $6.00.

This book is now an established classic for the history of biology up to the beginning of the present century. Much of what it contains should be the common culture of biologists everywhere. Although the author had planned to bring the book up to date, the appearance of Dawes' book *A Hundred Years of Biology* "made superfluous such an attempt." We are not so sure, and regret that Dr. Singer abandoned the attempt since it would have been of great advantage to have a comprehensive view of recent developments, even if inevitably incomplete. *J. W. Hedgpeth, Pacific Marine Station, College of the Pacific.*

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A History of Cytology. ARTHUR HUGHES. 158 pp., illus. Abelard-Schuman, Inc., 404 Fourth Avenue, New York 16, New York. (1959) $5.00.

This is said to be "the first comprehensive history of cytology ever published in any language." The author is University Lecturer at Cambridge University. He published his first book, *The Mitotic Cycle*, in 1957.

In this new work he presents more than a historical succession of events. He correlates the progress of each new stage with the technical advances available, e.g., "The electron microscope did not become a cytological instrument until the ultra-microtome was developed." He tells of certain theories being introduced at different times "under different guises." He mentions certain techniques which had lapsed into disuse for decades to be revived as new research horizons opened. He hopes that "a greater awareness of historical perspective" will be a boon to cytological literature. Such awareness "might help to dispel the illusion too often implicit in reports of fresh discoveries, that final secrets are nearly in reach."

Each of the six chapters is interestingly documented and supported with a lengthy bibliography. The chronological stages of microscopical observation are covered in the first chapter. Chapters 2, 3, 4, and 5 give selective treatment to more limited cytological areas such as recognition of the cell, division of the cell and nucleus, inheritance theories and the pertinent role of the nucleus, and a history of cytoplasmic studies.

Having traced these main avenues of cytological inquiry, the author devotes the final chapter to broader implications of the cell doctrine and their impact upon the related ever-expanding areas of general biology.

Twelve pages of historical half-tone plates preceded by detailed explanations are included before the eight-page index.

This historical contribution fills a needed gap in our contemporary biological literature and should alert more biologists to the significance of historical awareness. *Joseph P. McMenamin, American Institute of Biological Sciences.*

The Doctor Business. RICHARD CARTER. 283 pages. Doubleday & Company, Inc., Garden City, N.Y. (1st edition 1958) $4.00.

This is a well written and interesting book, analyzing critically and frankly the economic and organizational policies and details of medical practice and of the American Medical Association. It is based on long and extensive research and exhibits a successful attempt on the part of the author to deal with the many controversial subjects fairly and objectively. This book discusses in general and specific terms the efforts of the A.M.A. to protect the right of individual practitioners to establish their own prices; the traditional fee system of medical billing; economic pressures on physicians; health services; health insurance and pre-paid medical plans; the cost of diagnosis and treatment; overcharging of patients; various aspects of medical delinquency such as fee-splitting and unnecessary hospitalization, surgery or other treatment; the relation of the A.M.A. to the pharmaceutical industry, labor, and government and various aspects of medical politics; medical public relations; malpractice; theoretical and practical medical ethics; and the current supply of physicians. This is an important book for the general public since it deals with the above and many other urgent questions of modern medical care and provides patients or potential patients with information useful to them in terms of their own medical-economic interests. *George W. Casarett, University of Rochester School of Medicine and Dentistry.*

British Mammals. MAURICE BURTON. 64 pp., illus. Oxford Visual Series, Oxford University Press. (1958) $2.75.

This delightful little mammal book is the seventh volume in the Oxford Visual Series. It gives an account of the life and behavior of some of the commoner wild British mammals. The 30 short chapters describe how mammals find and store their food, and communicate with each other. It describes their play, courtship and the manner in which they rear their young. Learning in young animals, animal intelligence, hibernation, predation, the rise and fall of populations, interesting legends, and the economics of British mammals are discussed. An excellent presentation of the manner in which mammals are studied will be of value to the beginning student of these creatures. While references are not included in the body of the volume, a summary account closes the volume with a listing of the several book and monographs of British mammals—a decided aid to the investigator who wishes to explore the field more fully. The 76 halftones and line drawings, all illustrating specific phases of life and habits, contribute materially to the text. *W. J. Hamilton, Jr., Cornell University.*

Inside the Living Cell. J. A. V. BUTLER. 174 pp., illus. Basic Books, Inc., New York. (1959) $3.50.

It is good to know that a scientist of the author's status will take time to produce a book of this type. The author is a professor of physical chemistry at the University of London and head of the Department of Physical Chemistry at the Chester Beatty Institute of Cancer Research in London. He writes in his preface, "I have tried to make the style of this book reasonably simple while still maintaining a level of information and comment which, I hope, will not be without interest to students of science and also scientists who are not experts."

Twenty well-organized chapters deal with the most significant contributions advancing our present concepts of the living cell. Students will find excellent survey chapters on genes, mutations, theories of cancer, antibodies, viruses, hormones, specialized cells, behavior, and aging. Sufficient historical highlights behind the development of each biological concept is presented before bringing the reader up-to-date on the newest ideas.

The reader's interest will be captured with Butler's brief responses to recent or current research. Typical of this is his discussion of the discovery of "transforming principles." He mentions a 1957 paper on the transformation of ducks of one variety into ducks of a second variety. This was reported as the result of DNA injections into ducklings "from the eighth day after hatching." He comments that "further experiments are required before it can be regarded as certain that DNA injected into animals can really change the genetic characteristics."

Forty-four illustrations were evidently carefully planned to support the author's objectives. There are sixteen excellent photographs including electron micrographs and twenty-eight line figures.

Appendix I provides relevant chemical formulae. Appendix II gives chapter-correlated lists of selected references and books for further reading.

Dr. Butler's easy style and approach has not resulted in unnecessary dilution. He has done well in achieving the purpose set forth in his preface. *Joseph P. McMenamin, American Institute of Biological Sciences.*

Science and Liberal Education. BENTLEY GLASS. x + 115 pp. Louisiana State University Press, Baton Rouge. (1959) $3.00.

★The Survival Book. PAUL H. NESBITT, ALONZO W. POND, and WILLIAM H. ALLEN. v + 338 pp.; illus. D. Van Nostrand Company, Inc., Princeton, N. J. (1959) $7.50.

Science in Progress. Edited by HUGH TAYLOR. xii + 379 pp.; illus. 11th Series. Yale University Press, New Haven, Conn. (1960) $7.50.

***Classic Papers in Genetics.** Edited by JAMES A. PETERS. vi + 282 pp.; illus. Prentice-Hall, Inc., Englewood Cliffs, N. J. (1959) $3.95.

REVIEWER'S NOTE

In the April 1960 issue of the AIBS *Bulletin*, I presented *for biologists* a review of *Methods of Correlation and Regression Analysis* by Mordecai Ezekiel and Karl A. Fox, published by John Wiley and Sons, Inc. (1959). It has been brought to my attention that my comments concerning Fisher's and Student's papers of the twenties are not justified since they refer to a preface statement appearing in the first edition of this book. Much to my shame, I find that I was in error as I failed to note the source of the quotation even though it was quite clearly stated. At this late date, I can only offer my apologies to the authors for such an asinine statement on my part.

In the statement ". . . the book was written by economists and for economists with a very limited background in mathematics and statistics" I did not wish to imply that the authors had such a background as both are competent statisticians.

Upon completing this unfavorable review, I hesitated to have it published as I realized that personal opinions influence a reviewer's comments. However, a conscientious reviewer must clearly state his honest opinion in a review. This review is no exception to the fact that symbolic notation and pedagogic procedures are a reflection of a person's training which consequently are reflected in a review. I attempted to present my honest opinion of the value of this book to biologists even though I knew it would result in unpleasant comments from economists and possibly others.

My remark on fitting a regression line through zero refers specifically to the author's comment in paragraph 6 on page 79. *Vincent Schultz, Ecologist, Environmental Sciences Branch, Division of Biology and Medicine, U.S. Atomic Energy Commission.*

ERRATUM

In the "Coming Events" section of the Newsletter *In Brief, In Biology* for May, the Pacific Science Congress of the Pacific Science Association is incorrectly listed as scheduled for August 21–Sept. 6 of this year. The congress actually is scheduled for August 21–Sept. 2, 1961.

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Eberbach Corporation	45
Labline, Inc.	7
Lourdes Instrument Corp.	48
The Macmillan Co.	Cover 3
McGraw-Hill Book Company	10
The C. V. Mosby Company	4
National Appliance Company	12
Prentice-Hall, Inc.	47
The Ronald Press Company	13
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This work is the most comprehensive study to date on the ixodid ticks of the USSR published in the Russian language. It was started by B. I. Pomerantzev but due to his untimely death was completed by his wife, G. V. Serdukova.

The author has divided his book roughly into two sections, the first dealing with the subject in an introductory theoretical manner; the second, and major portion of the work, dealing primarily with the classification and identification of the various forms.

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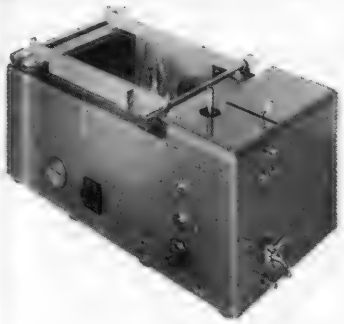

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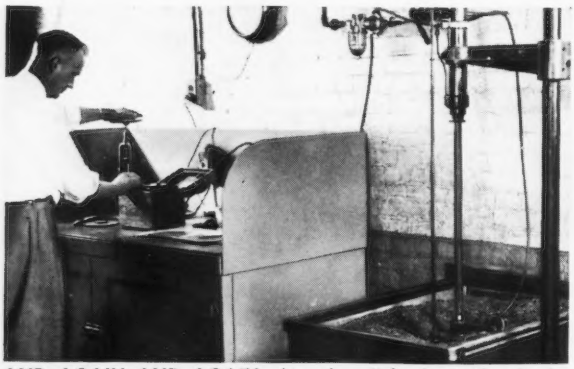

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